Iron and Steel ENGINEER

ENGINEERING SERVICE TO THE IRON AND STEEL INDUSTRY SINCE 1907

JULY, 1953

TECHNOLOGY DEPT.

TABLE OF CONTENTS, Page 55

PUBLIC LIBRARY
AUG 1953
DETROIT

The WEAN ENGINEERING COMPANY, Inc.
WARREN OHIO

√R V. 30 July - Dec. 1953

FOUR FIT IN THIRTY INCHES

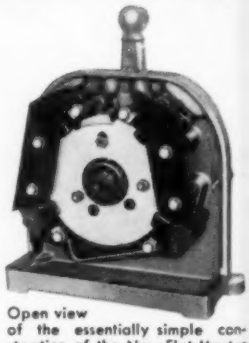
and Cutler-Hammer's NEW FLAT MASTER has grip release of off-position latch

In introducing Cutler-Hammer's New Flat Master, we don't have to tell an experienced steel man the advantage of being able to mount masters on 7½" centers. The New Flat Master is only 6 15/16" at greatest depth. This means these masters can be grouped in such a short span, the operator has any one in easy reach without stretching at all. It means he doesn't get so tired. It means his efficiency stays high.

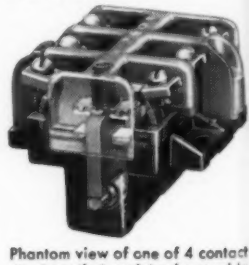
The advantages of the squeeze grip release of the off-position latch are equally compelling. Release results simply from tightening the normal grip. No extra motions. Less fatigue. And as easy and desirable as the squeeze grip release is in any position, it becomes a necessity when a master is mounted overhead.

These are but two of the many features making the Flat Master ideal for crane cab, open hearth charging machine and "all-vision" cab use. The Flat Master is designed throughout the better to meet steel mill needs. The rugged substantial cover lifts off straight up. The contact structure is simplified, all parts easily accessible, and easy to maintain. Movable and stationary contacts are readily replaceable, or the group assembly of 3 sets of contacts and operating rollers can be easily replaced as a unit. Twin break special alloy contacts, arc resistant molded supports, etc., provide long contact life and trouble-free service. There is ample wiring space. The sealed bearings are permanently lubricated. Many other features of fine, dependable performance recommend you get further information at once. CUTLER-HAMMER, Inc., 1269 W. St. Paul Ave., Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

CUTLER-HAMMER
MOTOR CONTROL
C-H



Open view of the essentially simple construction of the New Flat Master and standardized contact structures that provide 5 speed points in either direction.



Phantom view of one of 4 contact structures that are interchangeable with many other C-H masters and switches. Standardized, simplified, sturdy.

IRON AND STEEL ENGINEER, published monthly by Association of Iron and Steel Engineers, 1010 Empire Bldg., entered as second class matter January 25, 1924 at Pittsburgh, Pennsylvania, under Act of Congress, March 3, 1879. $7.50 per year in United States and Canada, $10.00 foreign countries. Volume 30, No. 7.

Tech

drawbenches

GOOD EQUIPMENT BRINGS DOWN PRODUCTION COSTS

• Whatever the requirement for cold drawing equipment, Aetna-Standard can deliver. This company specializes in cold drawbenches, wire drawing and other equipment for drawing steel, copper, brass, aluminum and other ferrous and non-ferrous materials. Aetna's benches range in pulling capacity from 1,000 to 300,000 pounds pulling capacity with single, double or triple drawing.

In addition to drawbenches, Aetna builds such equipment as hydraulic squeeze pointers, bull blocks, piercing mills for the brass and copper industry, wire drawing machines and pointers.

A pioneer in cold drawing, Aetna-Standard has been building equipment since 1904 and developed many of the innovations in the business.

ASSOCIATED COMPANIES

Hoyt Wrightson Machine Company, Ltd., Birmingham, England — Great Britain, Finland, Sweden, Norway, Denmark, Union of South Africa, Australia and Southern Rhodesia

Aetna-Standard Engineering Company, Ltd., Toronto, Ontario, Canada

H. Castelfel, Inc., New York, N. Y. — Mexico, Central and South America

Société de Constructions de Strasbourg, Paris, Bruxelles, France, Belgium, Holland, Luxembourg, Switzerland

Deutsch Atlaswerke-Gesellschaft, Duisburg, Germany — Germany, Austria, Czechoslovakia, Greece, Turkey, Egypt

Società Italiana Forme Acciaio, Milano, Italy — Italy

Aetna-Standard Company, Ltd., Tokyo, Japan — Japan

Hale & Kellgren, Inc., Akron, Ohio — Representative for the Rubber Industry

THE AETNA-STANDARD ENGINEERING COMPANY • PITTSBURGH, PA.

Aetna-Standard

PLANTS IN WARREN, OHIO • ELLWOOD CITY, PENNSYLVANIA

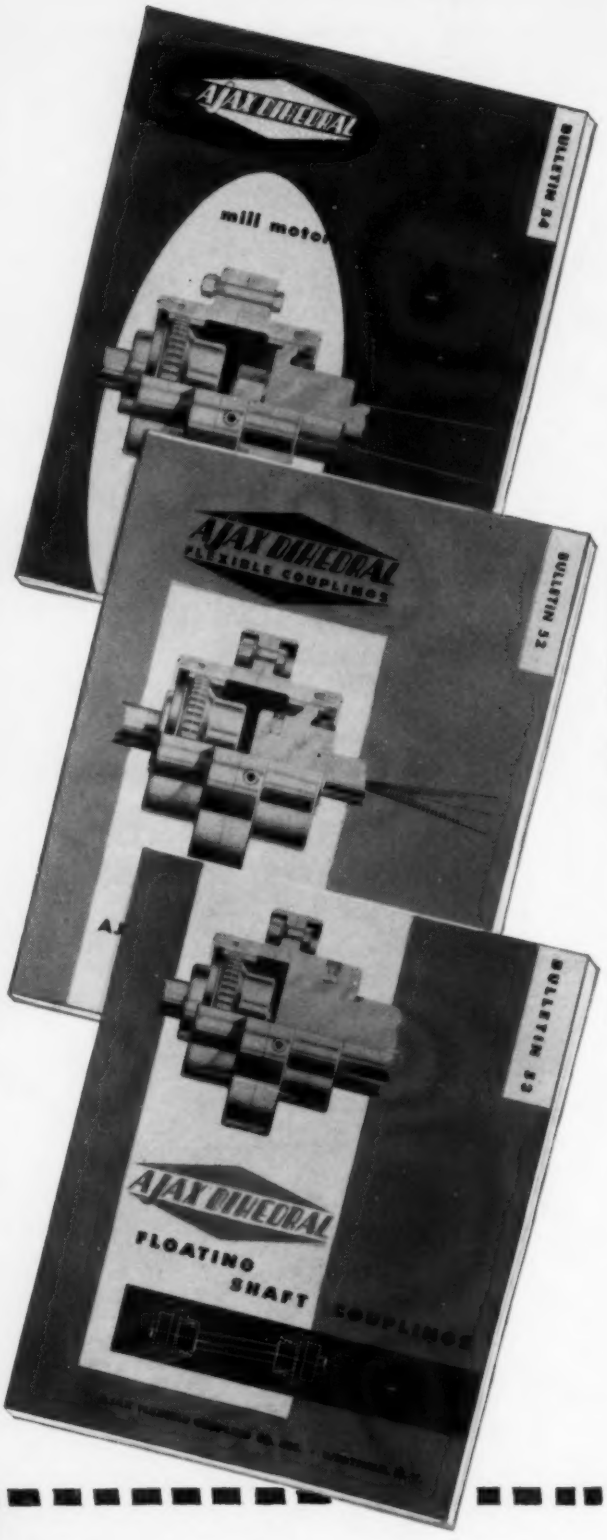
Designers and Builders to the Ferrous, Non-Ferrous, Leather, Rubber, and Plastic Industries

Every Man Who Wants to Get Rid of Misalignment Headaches Should

SEND FOR THESE NEW

AJAX DIHEDRAL

COUPLING BULLETINS



● Every man who is up against misalignment problems can get a lot of help from these Ajax Dihedral Coupling Bulletins.

They cover standard, floating shaft and mill motor type couplings.

They handle misalignment heretofore considered excessive. Standard dihedral teeth cut for 4° misalignment. Teeth to handle up to 12° misalignment cut to special order.

Tooth clearance (backlash) held to lubrication film requirements. All teeth hardened to 50-55 Rockwell C. Write or mail coupon for full information on America's finest flexible coupling.

AJAX FLEXIBLE COUPLING CO. INC.
Westfield, New York

Please send bulletins on Ajax Dihedral Couplings addressed to my personal attention.

*Name*_____

*Concern*_____

*Street*_____

*City*_____ *State*_____

STEEL MILL CRANES . . .

by "Shaw-Box"

Before you buy your next mill crane, investigate "Shaw-Box" Cranes built to A.I.S.E. standard No. 6 specifications. You'll find you get more crane for your crane dollar since you have less to pay for engineering. "Shaw-Box" already has standard A.I.S.E. designs for cranes ranging from 15 to 100 tons.

In "Shaw-Box" Cranes, you get cranes built exactly to your specifications plus the advantages of "Shaw-Box" engineering, manufacturing techniques, fine workmanship, performance, and maintenance conveniences that have built an enviable reputation for all "Shaw-Box" equipment.

SEND ALL YOUR INQUIRIES FOR CRANES AND SOAKING PIT CARRIAGES TO "SHAW-BOX".

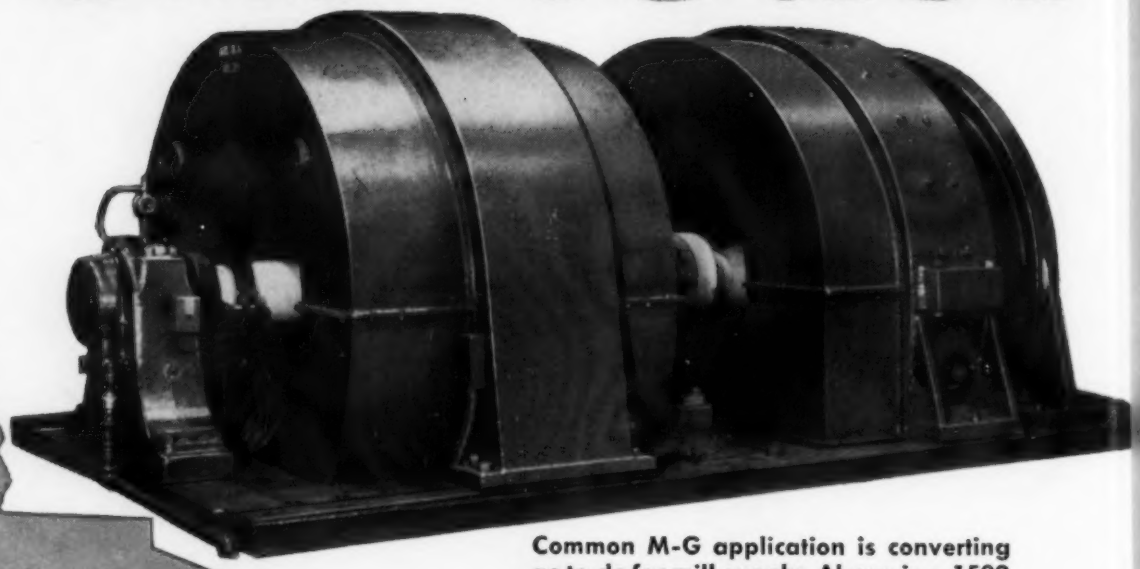
"Shaw-Box" CRANES

MANNING, MAXWELL & MOORE, INC.

Muskegon, Michigan

Builders of "Shaw-Box" Cranes, 'Budgit' and 'Load-Lifter' Hoists and other lifting specialties. Makers of 'Ashcroft' Gauges, 'Hancock' Valves, 'Consolidated' Safety and Relief Valves, and 'American' Industrial Instruments.

From Coast



Common M-G application is converting ac to dc for mill supply. Above is a 1500 kw synchronous set in eastern mill.

WEST

This 8-machine 2000 kw M-G set supports a two stand, four high tin temper mill with generators opposite their mill motors.

MIDWEST

A 56-inch, four stand tandem cold reduction mill is supported by this 7-machine 7750 kw synchronous motor-generator set.

EAST

Three 3-machine 6000 kw synchronous M-G sets supporting six finishing stand motors in a large East Coast steel rolling mill.

TEMPER MILL

Three midwestern single stand temper mills are supported by these M-G sets. Synchronous motors of 1750 hp drive each set.

to Coast!

ALLIS-CHALMERS M-G SETS ARE WIDELY USED IN SUPPORT OF STEEL MILL DC DRIVES

MAJOR STEEL PRODUCERS from Coast to Coast use Allis-Chalmers motor-generator sets. This nationwide acceptance in heavy duty service is proof of their durability and quality.

These representative M-G sets indicate the wide variety in design and size available. Allis-Chalmers has long experience with steel mill needs — having built M-G sets for all current applications — and will build special for any new requirement that may arise.

Motor-generator sets give you:

1. Power factor correction.
2. Regenerative braking.
3. Quick starting for emergency demand.

Only Allis-Chalmers gives you M-G sets with the exclusive *Frog-Leg* armature winding that ***eliminates injurious commutator sparking.*** *Frog-Leg* winding connects bars of equal potential through the winding itself . . . producing a perfectly equalized winding without the use of cross-connectors.

For full details on this heavy duty steel mill rotating equipment, ask for M-G Set Bulletin 05B6032A and Large DC Motor Bulletin 05B6002A. For your copies, just call the nearest A-C office or write direct to Allis-Chalmers, Milwaukee 1, Wisconsin. A-3920

Frog-Leg is an Allis-Chalmers trademark.

PICKLING LINE

A pickling line in an eastern steel mill is supported by this 4-machine 1375 kw, 720 rpm synchronous M-G set.

RECORD BREAKER

A motor room, completely equipped by Allis-Chalmers, powered this 80-inch western hot strip mill to a new annual world tonnage record.

ALLIS-CHALMERS

Power, Electrical, Processing Equipment for Iron and Steel

BEHIND THIS DOOR lies the secret . . .

of why your Heyl & Patterson Heavy Bulk Materials Handling Installation will last . . . and last . . . and last

Since 1887 Heyl & Patterson has designed, fabricated and erected well over 3000 Heavy Bulk Materials Handling installations of all types . . . from coal tipples to complete coal preparation plants . . . from pig casting machines to mammoth ore bridges.

Today the great majority of these installations are still in operation, including many that were built 50 to 65 years ago.

The H & P Service Department is an important factor in the consistent long life of all Heyl & Patterson installations.

Night or day, the Heyl & Patterson Service Department is prepared to go all out to supply H & P customers with replacement and spare parts in the shortest possible time.

This on-the-spot service is facilitated by Heyl & Patterson's system of recording all detailed drawings on 70 mm microfilm, which is available at a moment's notice.

Time and time again the H & P Service Department has done the "next to impossible" to keep H & P installations in operation. Letters of thanks from customers prove this to be the rule rather than the exception.

The operations of the H & P Service Department in working with the customer after a contract is completed is another example of the "follow-through" that your business receives at Heyl & Patterson . . . the "follow-through" that is possible because we have our own Engineering Department, our own Research Department, our own Machine Shop, our own Structural Shop, our own Erection Department and our own SERVICE DEPARTMENT.

All H & P departments work together to provide you with the world's finest Heavy Bulk Materials Handling Equipment.

Heyl + Patterson, Inc.

"SINCE 1887"

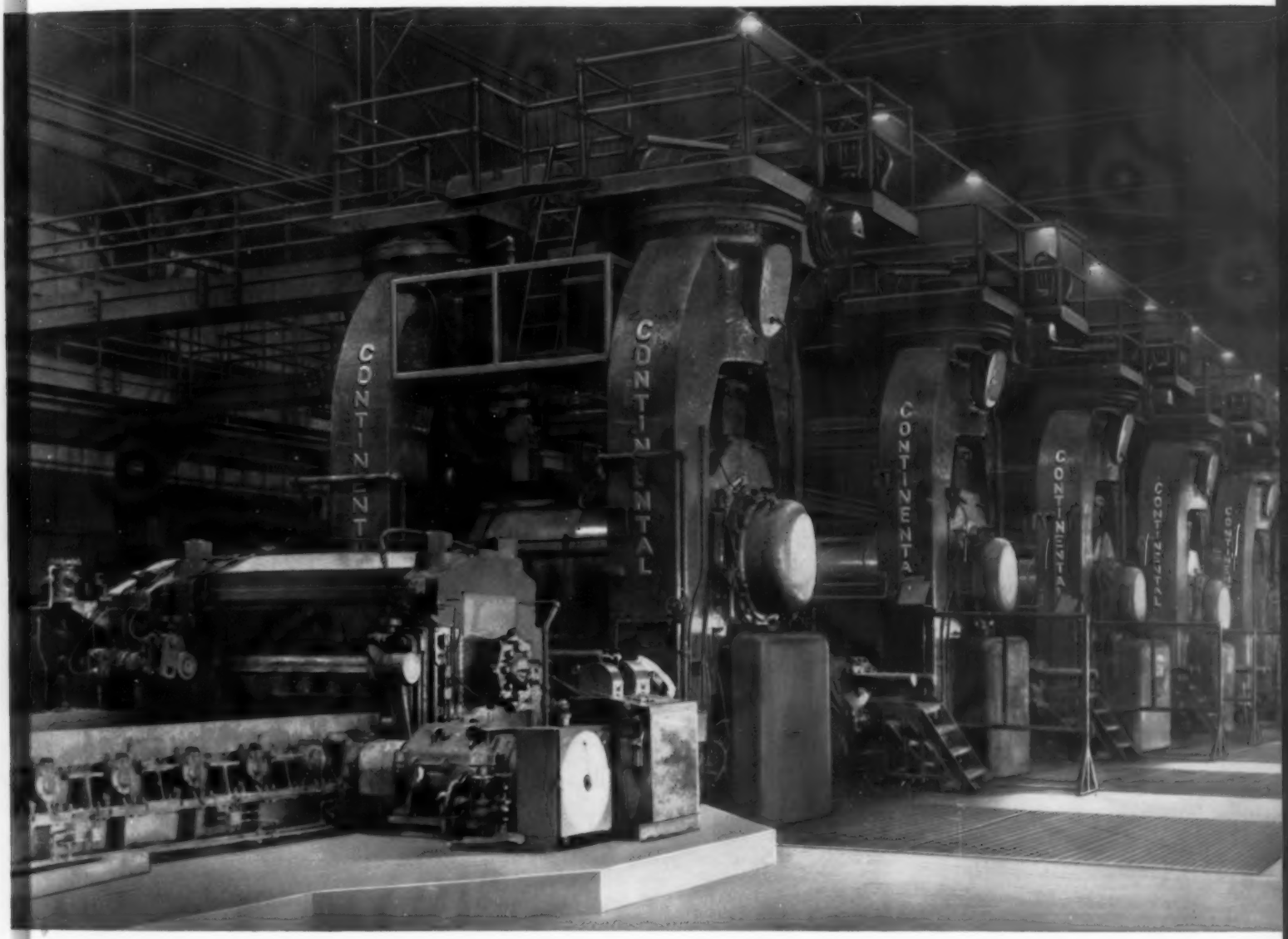
55 WATER STREET · PITTSBURGH 22, PA.

Heavy Bulk Materials Handling Equipment

All The Way from Design to Erection

CONTINENTAL

80-Inch HOT STRIP MILL



Complete Rolling Mill Installations

★ ★

SLABBING MILLS
UNIVERSAL MILLS
PLATE MILLS
HOT STRIP MILLS
COLD STRIP MILLS
TEMPER MILLS

Mills complete with Auxiliary Equipment

★ ★ ★

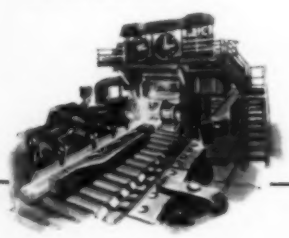
CONTINENTAL CHIPPER
ROLL LATHES
SPECIAL MACHINERY

BLOOMING MILLS
STRUCTURAL MILLS
RAIL MILLS
BILLET MILLS
ROD MILLS
MERCHANT MILLS

CASTINGS—carbon and alloy steel from 20 to 250,000 pounds

ROLLS—iron, alloy iron and steel rolls for all types of rolling mills

WELDMENTS—fabricated steel plate, or cast-weld design.

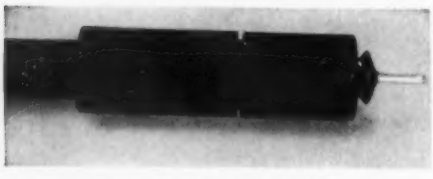


Plants at
East Chicago, Ind. • Wheeling, W. Va. • Pittsburgh, Pa.

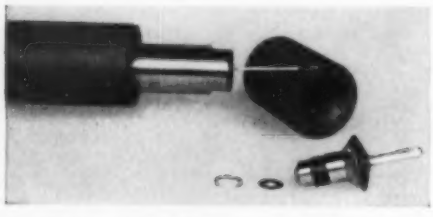
CHICAGO • PITTSBURGH

CONTINENTAL
Foundry & Machine
Company

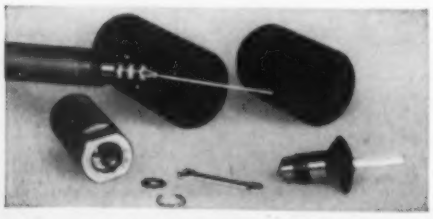
Tip of Immersion Couple ready for use. Graphite blocks, under spring tension, house the immersion end of the thermocouple element. The "hot" junction projects into the quartz sheath.



First step in replacing sheath. A retractor (not shown) releases the spring tension—exposes the tapered, stainless steel plug into which the quartz sheath is cemented.



After each immersion, the quartz sheath is replaced. Usually, a supply of sheaths, cemented into spare plugs, is kept on hand. Cement comes ready-mixed.



When the junction requires repair, terminal screws are loosened, sufficient wire is drawn down from its storage in the tube, a new junction is formed, and the unit is reassembled.

Simplified Maintenance

SPEEDS REPEATED BATH MEASUREMENTS WHEN YOU USE THE L&N IMMERSION THERMOCOUPLE

● Unique design of the L&N Immersion Thermocouple reduces routine maintenance to a simple operation performed right at the furnace. No time is wasted in elaborate repairs—or in transporting equipment to and from instrument maintenance shops. No valuable storage space is required for numerous stand-by units. No capital is tied up in surplus equipment.

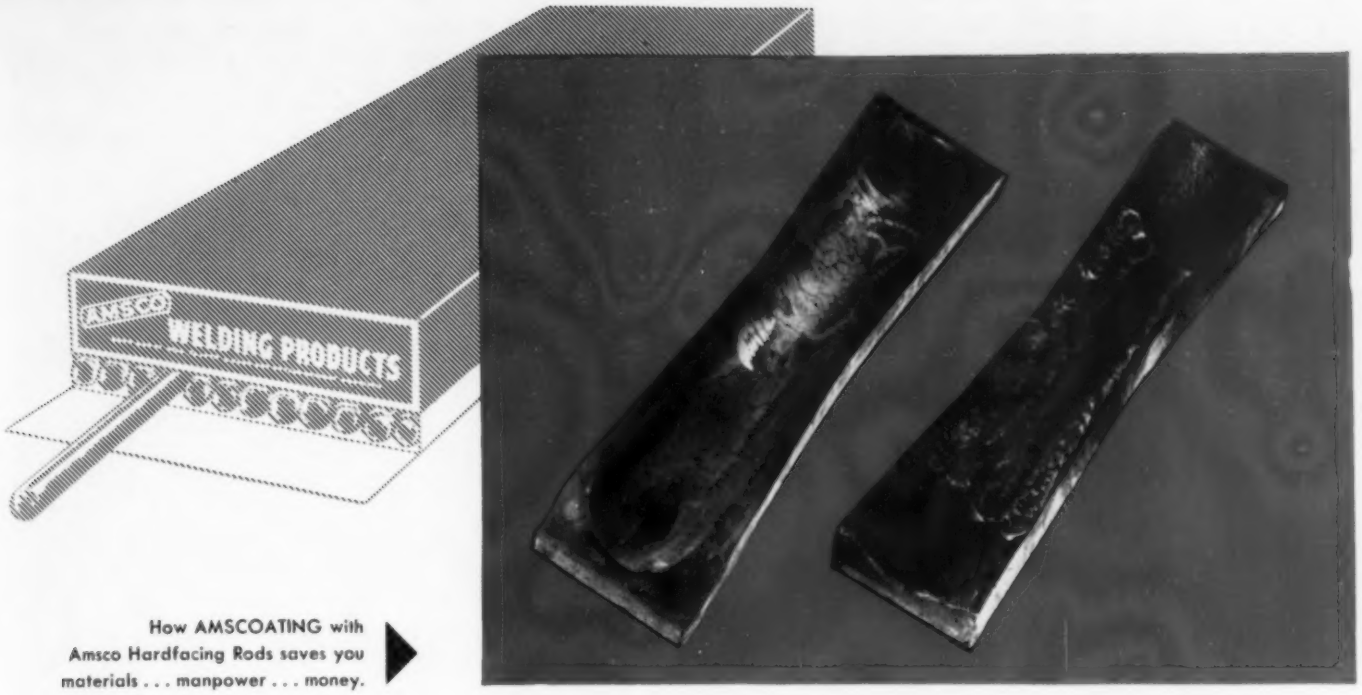
After each immersion in the molten metal, the operator simply replaces the plug-mounted quartz sheath protecting the "hot" junction of the couple, and is ready for the next measurement. When the thermocouple junction itself must be repaired, an adequate length of wire is simply drawn down from the reserve supply in the tube to form the new junction.

Since each unit is normally available on a full-time basis, equipment requirements are reduced. The usual installation consists of only one unit per furnace (with one Speedomax® immersion thermocouple recorder for every two units) and a stand-by unit for every two or three furnaces.

Ease of maintenance is but one feature of the L&N equipment. Accuracy of measurement is protected in various ways. Design of the thermocouple circuit minimizes junction error by putting lead-wire junction at the handle end of the unit. Instrument accuracy is protected by automatic standardization of the recorder measuring circuit during each immersion, only seconds before the immersed couple reaches bath temperature. Simplicity of operation is assured by the Recorder's Signal Light system, which guides the user through each step of the measuring sequence.

For full details, contact your nearest L&N representative, or write us at 4942 Stenton Ave., Phila. 44, Pa. for Process Data Sheet 643(1).

LEEDS NORTHRUP
instruments automatic controls • furnaces



How AMSCOATING with Amsco Hardfacing Rods saves you materials . . . manpower . . . money.

Amscoating these guide shoes kicks tube production up

AMSCOATING . . . stands for control of wear by Hardfacing . . .

Hardfacing Rods—and recommendations for their use—are as sound as the manufacturer who makes them. AMSCO has been fighting wear for a half-century—first with Manganese Steel, and later with AMSCO Hardfacing Products.

If you have a problem of wear caused by impact, abrasion, heat or corrosion . . .

Find out how AMSCOATING can save you materials . . . manpower . . . money!

Continuous production, greater safety and better weldability are three *good* reasons for Amscoating Piercer Guide Shoes.

These Piercer Guide Shoes are used at a large midwestern steel plant to hold a rotating hot bar in alignment during the initial piercing operation. Wear was not the main problem here. The condition to be avoided was "pick-up", where the bar becomes fused with shoe and literally explodes.

To lick this problem, which can result in expensive equipment damage and loss of life, the welding superintendent chose Amsco Thermalloy No. 4 for three reasons:

1. **Complete elimination of pick-ups . . . for greater safety and higher production**
2. **Better weldability . . . Thermalloy No. 4 covers heat checks, prevents small cracks that can cause pick-ups or seizing.**
3. **Amscoated shoes can be used many times . . . for big savings in replacement costs over a year's period.**

AMSCOATING permits big savings—through longer service and fewer replacements—on many other applications. If you have equipment that's subject to wear, the possible savings to you—are too big to be overlooked!

Write today for illustrated catalog—and nearest distributor's name.

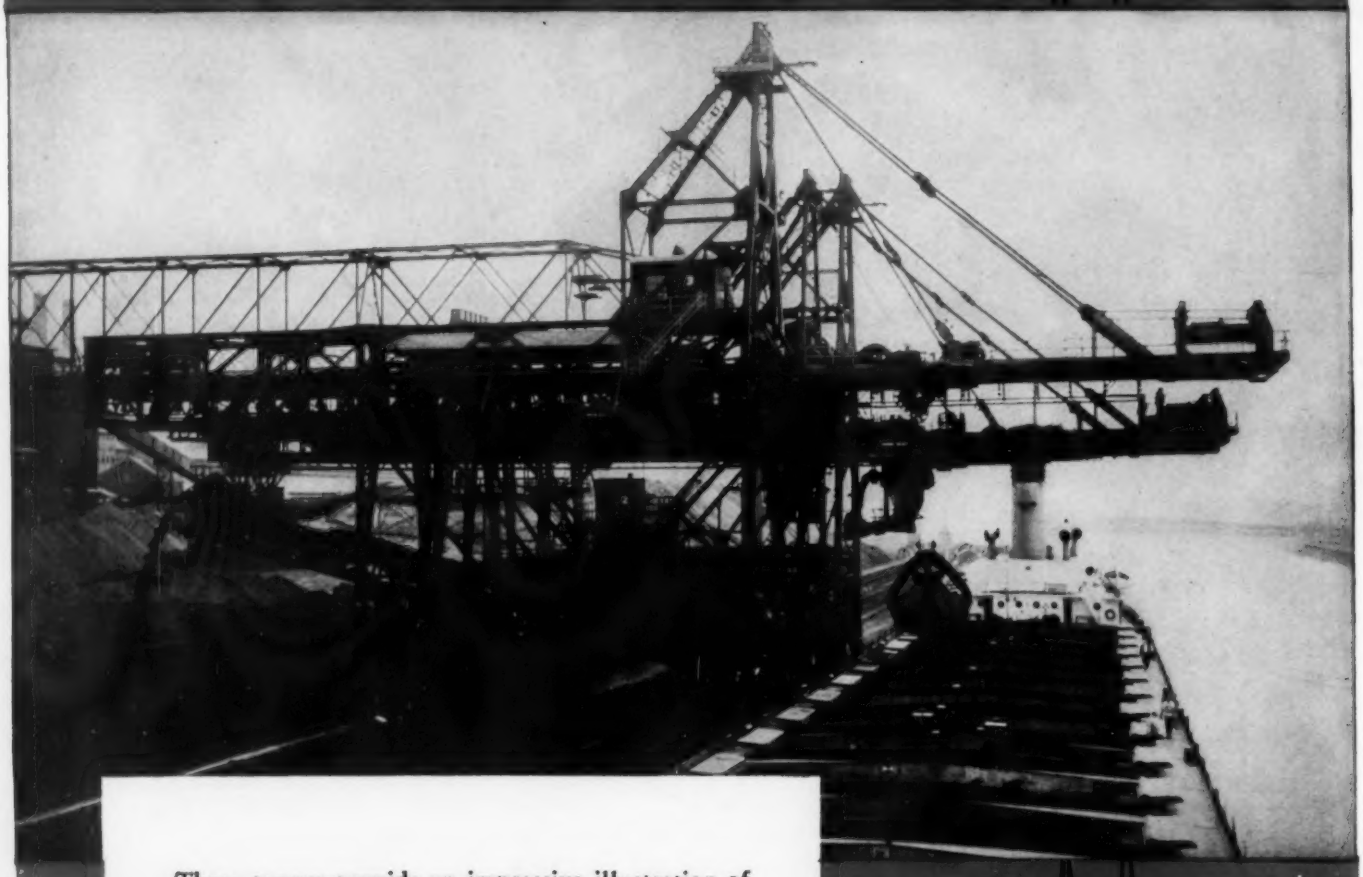
AMSCOATING
THE RIGHT WAY TO SAY HARDFACING

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION
411 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.
Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

UNLOADERS and BRIDGES
for Ore...Limestone...Coal



These towers provide an impressive illustration of the effective design and sturdy construction of Mead-Morrison equipment. The towers are provided with rotating buckets and are capable of unloading ore and limestone from lake steamers to trough, storage pile and high-line feeding the blast furnaces, at rates up to 1500 tons per hour for each tower.

Design features in these machines make them outstanding in ease of operation and smoothness of control. Be sure to consult Mead-Morrison on your material unloading and rehandling problems.

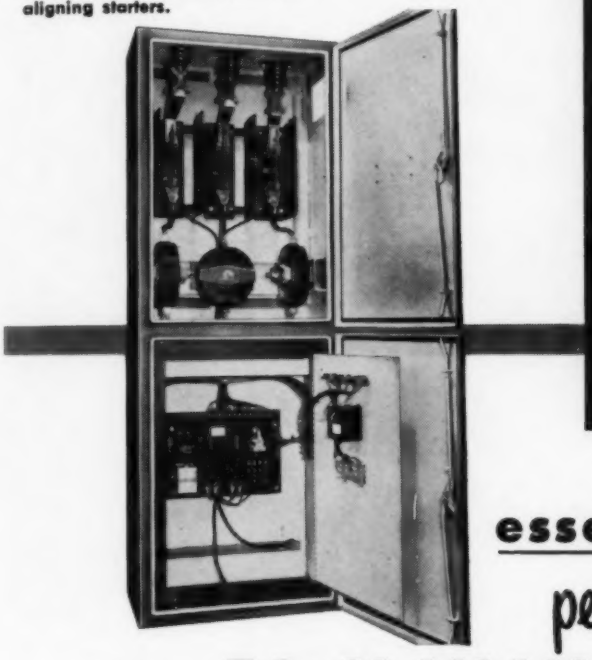
MEAD-MORRISON

Division of McKIERNAN-TERRY CORPORATION · *Manufacturing Engineers*

HARRISON, NEW JERSEY

600-Ton Verson Hydraulic Press for forging 155 mm projectiles. EC&M VALIMITOR Starters provide continuous protection for the 2300 volt hydraulic pump motors serving several of these Verson All Steel Presses in a southern shell plant.

A typical 2300 volt EC&M VALIMITOR Cubicle Starter with self-contained bus at top for connecting all the adjacent self-aligning starters.



essential drives deserve *permanent* "short-protection" and EC&M VALIMITOR Starters provide it

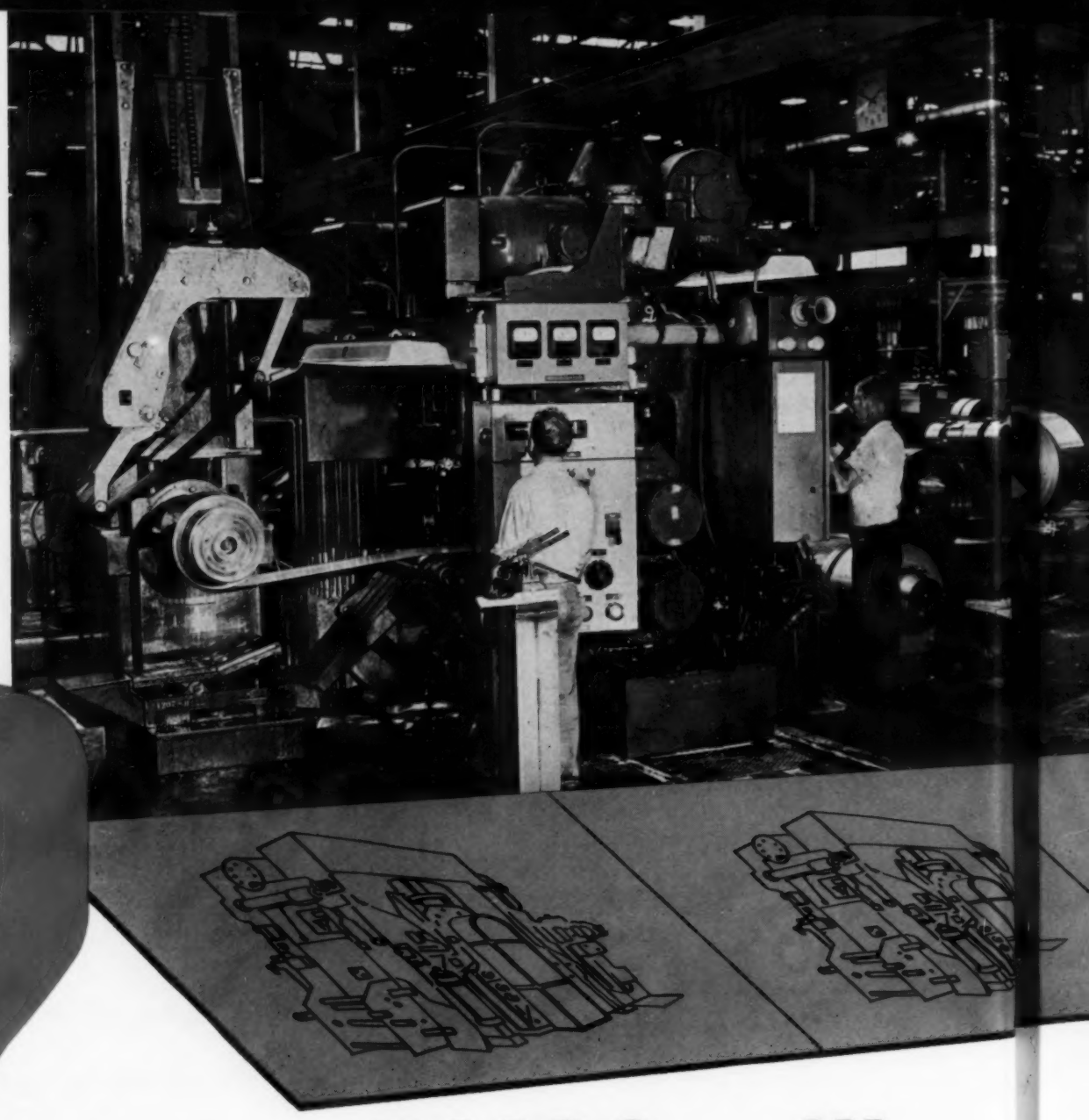
write for T9-117 reprint bulletin

Recently, in the case of a new plant, the consulting engineers were obliged to refigure "short-possibilities" twice because of changes in power plans. They also had to re-check all power equipment, including circuit breakers and motor starters.

Then—they heard about EC&M VALIMITOR Starters, which offered an ideal solution to the knotty problem.

No more calculations . . . no worry about starters being outmoded by an unexpected increase in available KVA, now or in the future. Furthermore, these EC&M Starters could be ordered by specifying only the motor name-plate data —, and after being applied, there was no danger of getting caught "short" with a "short" the starters couldn't handle. EC&M VALIMITOR Starters give *permanent* protection. Investigate them for your 2300-4600 volt motor-drives.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO



2 new BLISS mills

and do it better at Chase...

Higher production...closer tolerances...*less equipment*...all these are now a reality at the Chase Metal Works plant of Chase Brass & Copper Co., subsidiary of Kennecott Copper Corporation.

Chase wanted mills that would take a 50% reduction on brass strip at 500 fpm; and auxiliary equipment to handle coils weighing 200 lbs. per inch of width.

Bliss designed and built a pair of two-high mills, one 16″ x 16″ and the other 20″ x 22″, to suit various widths. Now quality and quantity of output from the new Bliss mills exceed that of the *five* old mills.

The Bliss mills run up to 1000 fpm and easily hold tolerances to 0.0005″; and these speeds offer quite an advantage on finish passes.

The 50% reduction made on Bliss mills is *twice* the amount possible on the old equipment. The Bliss units, with capacity of 200 lbs. per inch of width, handle 2400-lb. coils (for 12″ strip) on the

do the work of 5

16″ mill, and 3600-lb. coils (for 18″ strip) on the 20″ mill.

Bliss engineers sought carefully to include in the designs the desired characteristics of a mill suitable for reduction and finish rolling. The planished surface obtained is so good that further buffing is unnecessary.

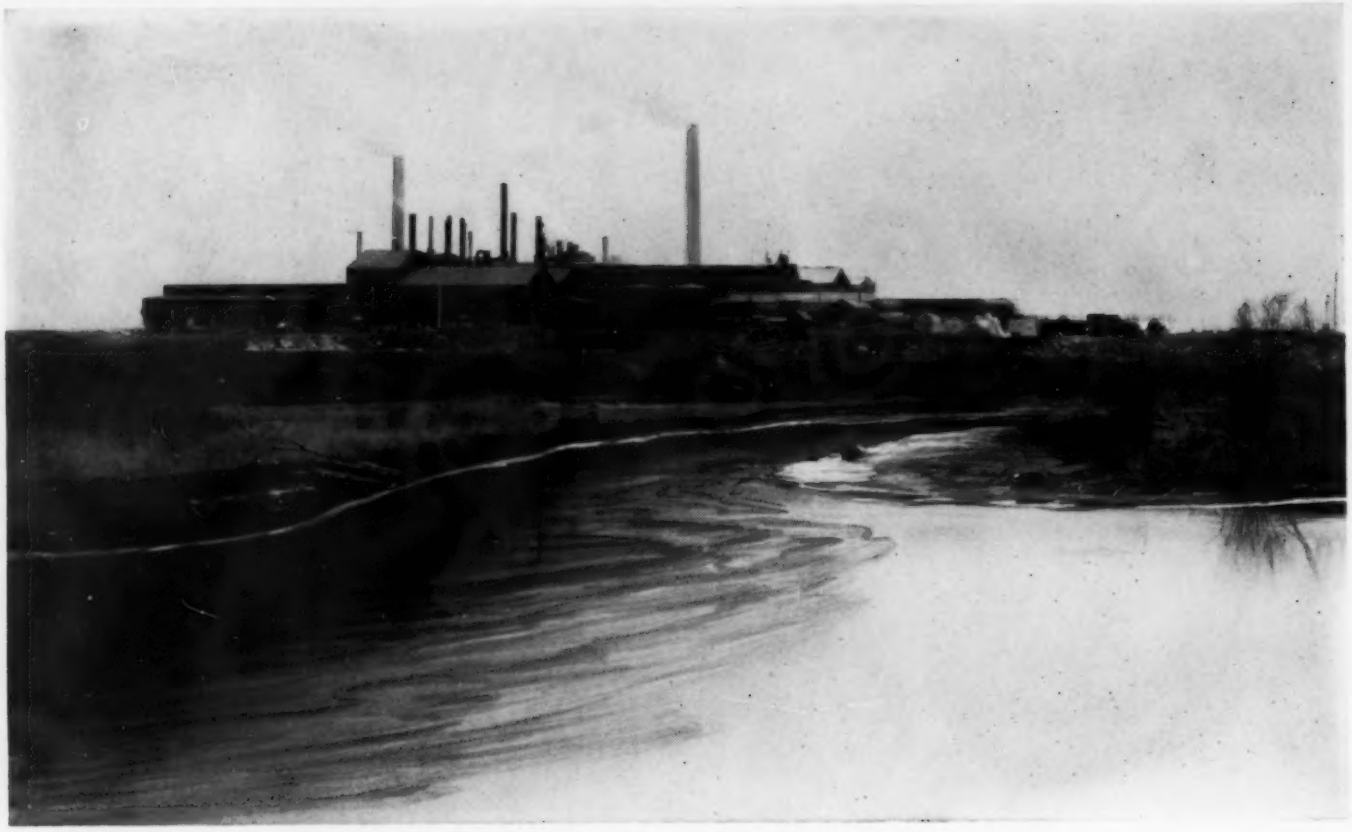
If you have a rolling mill production problem, you'll find as Chase did—that it pays to call in Bliss. Take the first step toward increased production: write for your copy of the 52-page brochure, "Rolling Mills and Accessories," Bulletin 40.

E. W. BLISS COMPANY · General Office: Canton, Ohio
ROLLING MILL DIVISION: SALEM, OHIO
E. W. Bliss (England) Ltd., Derby, England
E. W. Bliss Company (Paris), St. Ouen sur Seine, France

Branch offices in Chicago, Cleveland, Dayton, Detroit, Indianapolis, New Haven, New York, Philadelphia, Rochester, Toledo; and Toronto, Canada. West Coast Representatives: Moore Machinery Company, Los Angeles and San Francisco; Star Machinery Company, Seattle.
Other dealers in United States cities and throughout the world.

Remember: **for Presses, ROLLING MILLS and Special Machinery...**

It's Bliss



WORRIED ABOUT WASTE DISPOSAL?

Bailey Meters Help you to Reduce Pollution

● The disposal of industrial wastes without stream pollution calls for careful planning and continuous vigilance.

That's where Bailey Meters and Controls come in. We measure the flow and pH of sewage, sludge, and industrial wastes flowing in open channels or pipe lines. These and other factors, such as levels, rates of chemical feed, and flow of air, may be co-ordinated into a completely automatic system for the treatment and disposal of waste materials.

When you want fast, complete and authoritative answers to the measurement and control aspects of your waste disposal problems, reach for your phone and call your local Bailey Engineer. Offices in all principal industrial centers.

P-24

BAILEY
OPEN CHANNEL METERS

These indicating, recording and integrating meters are suitable for measuring industrial wastes, sewage, sludge, corrosive liquids, and irrigation water flowing in all types of open channel primary metering devices, such as Venturi flumes, weirs, or nozzle flumes. Electric or pneumatic telemetering permits location of receivers wherever desired. Ratio of flows and chemical feeds may be controlled automatically.

BAILEY METERS

BAILEY METER COMPANY

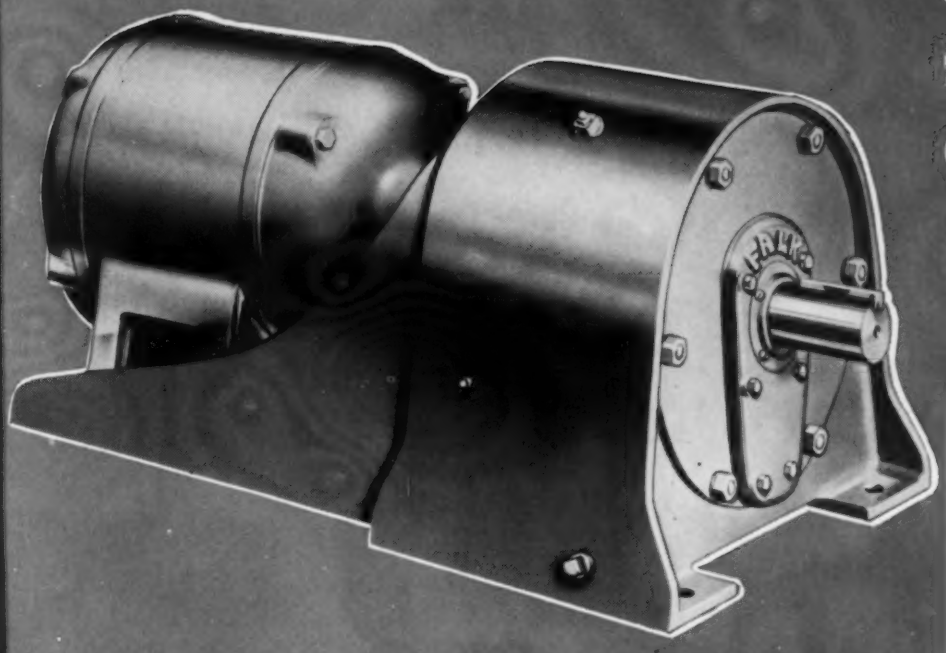
1047 IVANHOE ROAD
CLEVELAND 10, OHIO

Process Controls
TEMPERATURE · FLOW
PRESSURE · LEVEL
GAS ANALYSIS · RATIO

Choose the All-Motor type,

ALL-STEEL FALK Motoreducer

...with complete foot-mounted motor of ANY make ANY type ANY speed



Its exclusive, superior features mean LONG-RANGE ECONOMY!

You get more for your money in a FALK all-steel, All-Motor type Motoreducer. Here is the *only* compact motorized reducer with a separate foot-mounted, resilient Steelflex coupling-connected, standard motor without modifications! It accommodates *any* make, type, or speed of motor within the AGMA rating of the unit. Ratio can be changed within torque capacity of unit without modifying motor.

The simplified construction of the FALK All-Motor type Motoreducer means real long-range economy. Motors or reducer units can be quickly and easily interchanged from one line or plant location to another. Fully standard replacement motors from manufacturers' field stocks are always available without costly delivery delays or special motor or shaft modifications.

When you choose a FALK All-Motor type Motoreducer, you get the utmost in design, versatility of performance, and utility—plus the greatest possible dollar-for-dollar value throughout its traditionally long life... Available in any standard ratio from factory and distributor stocks throughout the country. Write for Bulletin 3104.

Every FALK Motoreducer has these "IN-BUILT" FACTORS

1 **All-steel Housings.** Unbreakable, strong, rigid. Generous overhung load capacities provided by wide bearing spans, large shafts and bearings.

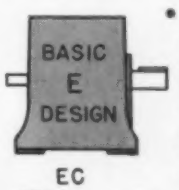
2 **Streamlined inside and outside.** Smooth, clean surfaces; machine welded construction conforms to NEMA motor frames.

3 **Sealed Housings.** Dual closures and one-way vents keep oil *in*, dust and moisture *out*. Units are splashproof, leakproof, dustproof.

4 **Positive Lubrication.** Large sump capacity ...oil-tight construction assures clean lubricant...direct dip of revolving elements provides positive lubrication at all speeds.

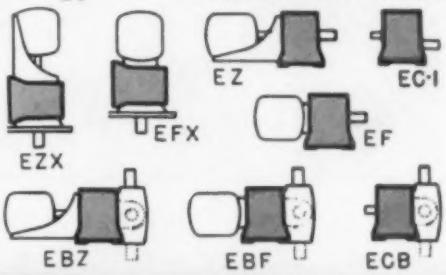
5 **Wide Speed Range.** Selective ratio combinations provide output speeds from 1.5 rpm to 1430 rpm with stock gears.

6 **Precision Gearing.** Heat-treated alloy steel, precision cut and shaved helical gearing throughout...quiet-operating crown shaved pinions...taper bored gears for easy ratio changes.



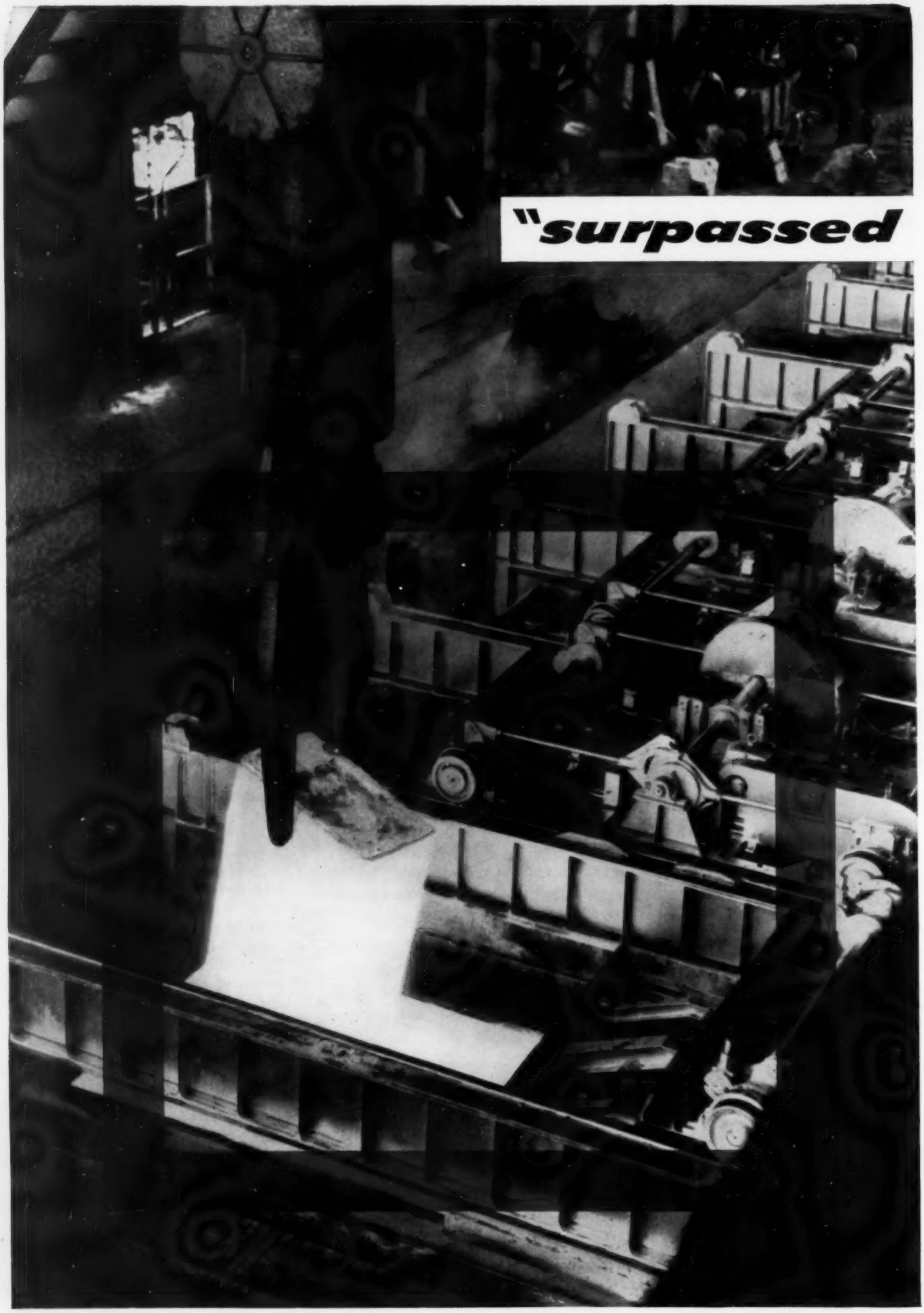
EC

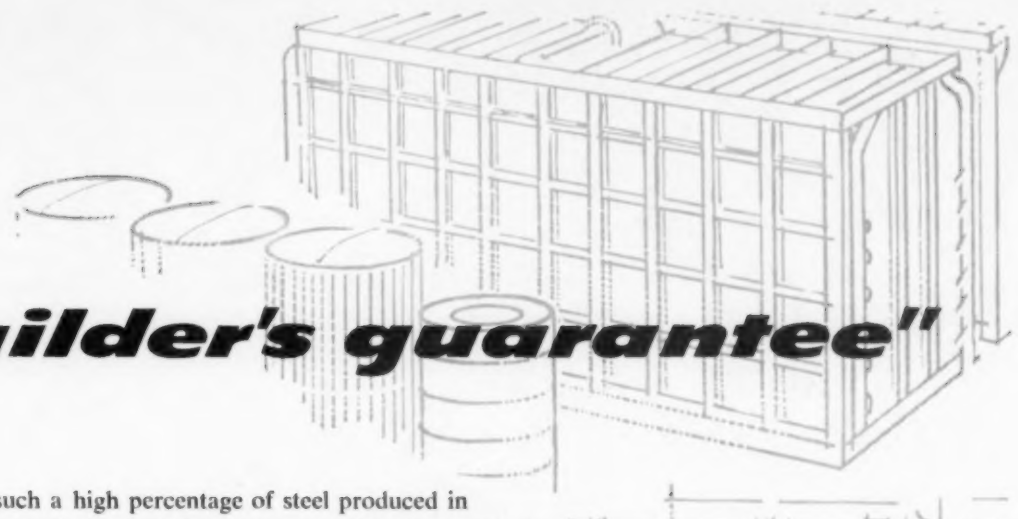
The basic E design permits maximum use of standardized parts . . . closer control over materials, processing, inspection and assembly . . . resulting in faster delivery from interchangeable stocked assemblies.



FALK ...a good name in industry

THE FALK CORPORATION 3001 W. Canal St. Milwaukee 8, Wis.


"surpassed



the builder's guarantee"

Why is it that such a high percentage of steel produced in this country passes through Surface Combustion equipment in one or more stages of its processing? Part of the answer might be furnished by a list of steel making advances in which our engineers have participated. The one-way fired soaking pit . . . the remotely located single recuperator serving a number of holes . . . the research which led to substantial increase in pit sizes without sacrificing the simplicity of the one-way firing principle . . . the jet pump which facilitates handling heated air in high volumes with low equipment maintenance . . . these you may recall as developments to which 'Surface' engineers contributed.

There's a more basic answer however: typically expressed in a customer's published report of comparatively recent 'Surface' soaking pit installation: "tons per hour . . . and fuel savings as shown by Btu ton figures . . . has *surpassed the builder's guarantee.*"

This business of making one's word good is by no means unique at 'Surface'. We like to believe however that we combine this old-fashioned way of doing business with an exceptionally effective combination of metallurgical and construction skills based on two generations of experience and growth with the steel industry.

Whatever long-range capital investments you may be planning in making pits, slab heaters, annealing covers, continuous annealers, or any equipment involving combustion, we suggest you tap the "proven resources" of cost-saving skills and experience at 'Surface'.

"Operative Results of One-Way Fired Recuperative Soaking Pits by E. H. Cauger and J. C. Stamm, Jr., IRON & STEEL ENGINEER, December 1952

Surface
STEEL MILL FURNACES

SURFACE COMBUSTION CORPORATION • TOLEDO 1, OHIO

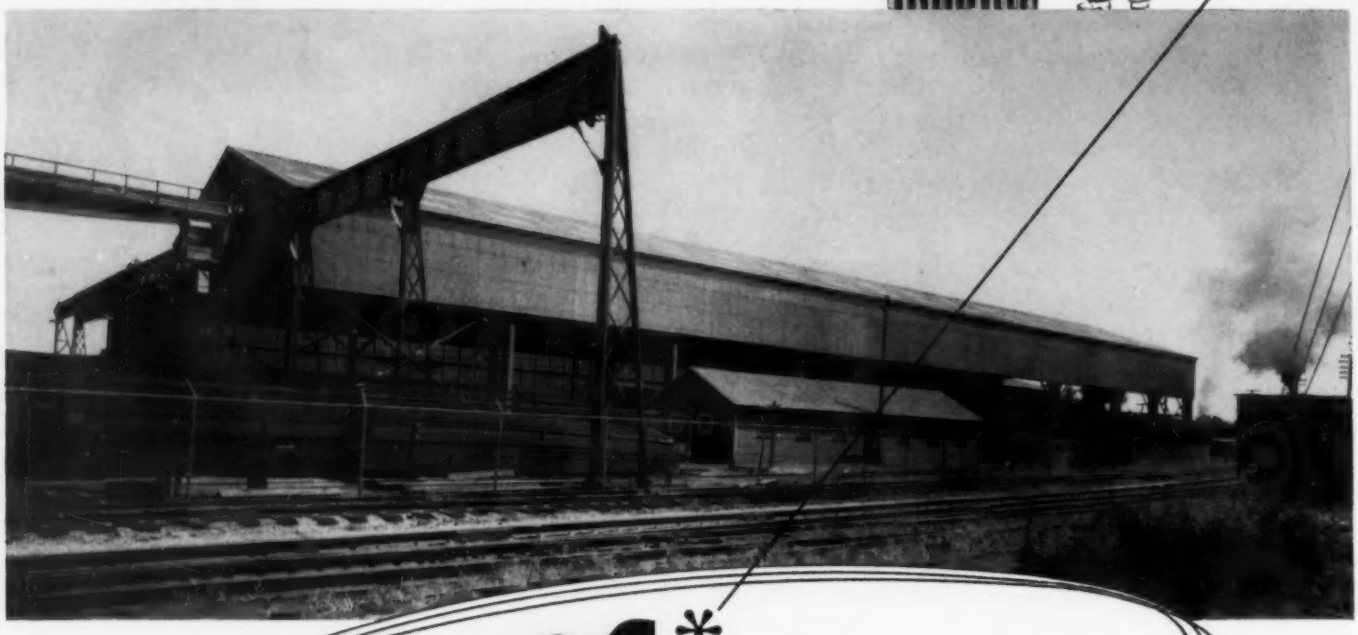
One-way fired soaking pits • Billet reheating furnaces • Slab heating furnaces • Continuous type, controlled atmosphere strip annealing and normalizing furnaces • Controlled atmosphere annealing covers for wire and rod • Controlled atmosphere annealing covers for coil and sheets • Continuous furnaces for heat treatment of steel plate • Controlled atmosphere furnaces for carbon correction in high alloy rod and bar stock • Continuous type bright annealing and normalizing furnaces • Prepared gas atmosphere generating equipment • Pit type convection furnaces for rod annealing • Stress relief furnaces • Wire patenting furnaces

DETROIT PUBLIC LIBRARY

We've solved hundreds of

MAINTENANCE PROBLEMS

with **Plasteel** ROOFING and SIDING because



MICA* makes the difference

ALL THE FEATURES OF FINE PROTECTED STEEL—WITH **MICA ADDED**

Industrial case histories prove Plasteel reduces maintenance hours and costs to a minimum. Especially, in the steel industry where buildings are exposed to every conceivable corrosive atmosphere. Whether it is smoke, dust, acids, fumes, alkalies, or a combination of them, these harsh conditions are hard on buildings and equally hard on maintenance budgets. Such buildings need Plasteel — the only protected metal roofing and siding that gives you *Mica* protection. *Mica makes the BIG difference*—it prevents the protecting oils in Plasteel's asphalt-plastic coating from drying out. But that's not all . . .

Let our representative explain how Mica-Protected Plasteel can solve *your* maintenance problems

Write or phone today

Plasteel

PRODUCTS

CORPORATION

WASHINGTON, PENNSYLVANIA

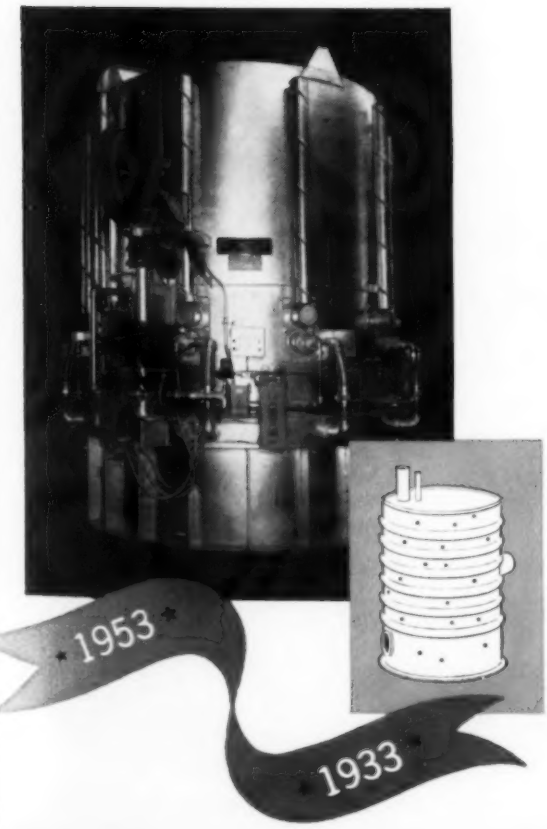
Offices in Principal Cities

PLASTEEL MICA-PROTECTED STEEL ROOFING AND SIDING

ISE 7-53

CORRUGATED SHEETS • FLAT SHEETS • INSULATED PANELS

20th year of annealing development



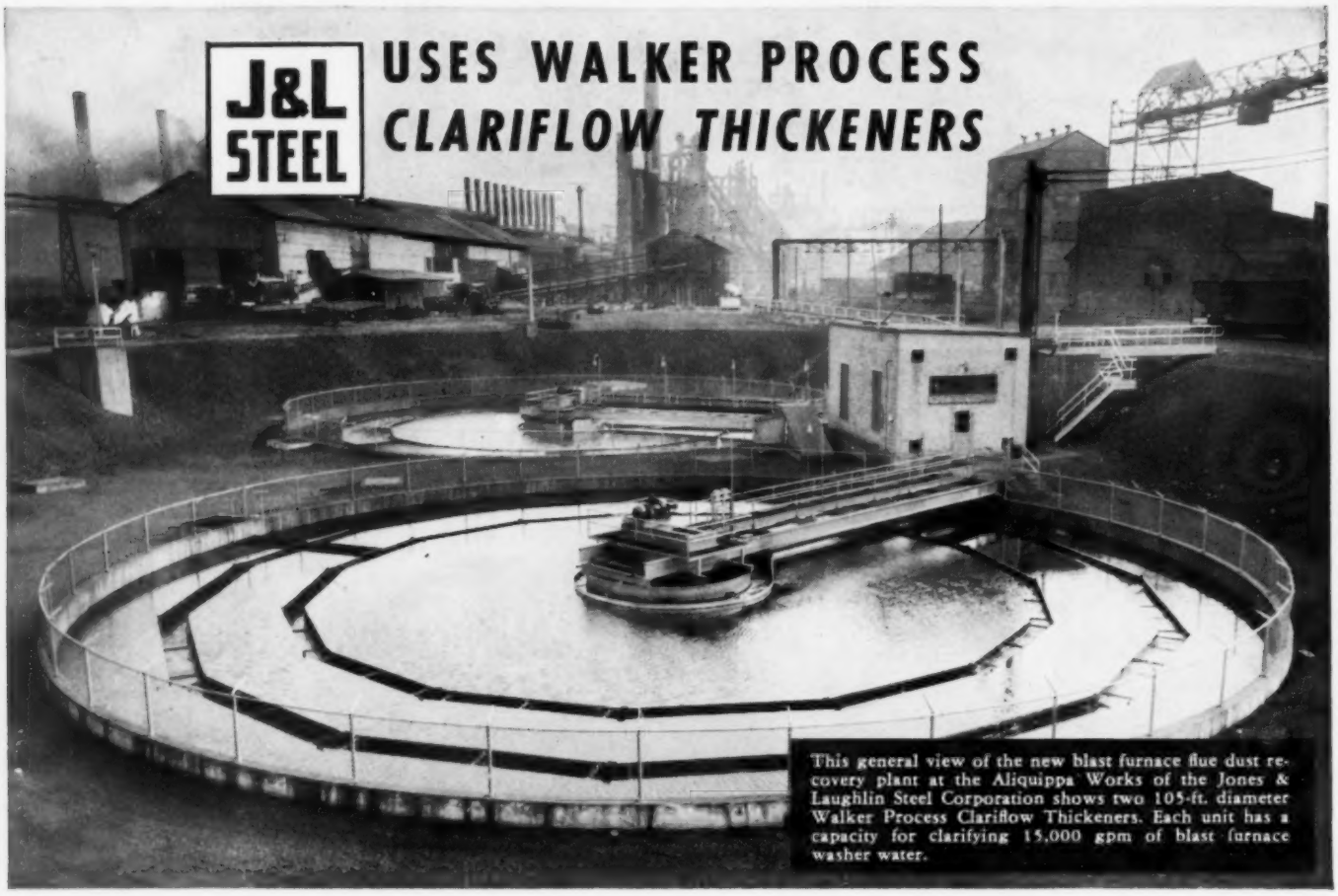
Twenty years ago penicillin, jet planes, radar control and atom bombs were unheard of . . . the nation was in the grip of its most disastrous depression and the steel business was practically at a standstill . . . yet, this was the time Lee Wilson chose to introduce his radiant tube annealing furnace. Steelmakers agreed that here was a great advancement in annealing practice, and as business picked up and steel came alive these steelmen adopted the Lee Wilson system. Constantly working to improve annealing processes, Lee Wilson, a few years later, announced a high convection method for annealing steel and again steel leaders approved.

Today Wilson Furnaces can be found in every leading steel making center the world over . . . and the new Wilson Single Stack Portable Base Furnace is an important topic of conversation whenever annealing is discussed.

In the past twenty years there have been many earth-shaking developments in practically every field of endeavor. To people interested in producing better steel, faster, at lower costs, the constantly new annealing processes of Lee Wilson have been a great part of this advancement.

Lee Wilson Engineering Co., Inc.

Cleveland, Ohio



This general view of the new blast furnace flue dust recovery plant at the Aliquippa Works of the Jones & Laughlin Steel Corporation shows two 105-ft. diameter Walker Process Clariflow Thickeners. Each unit has a capacity for clarifying 15,000 gpm of blast furnace washer water.

NEW BLAST FURNACE FLUE DUST RECOVERY PLANT

Removes Over 95% of Settleable Solids!

Single stage thickeners used

Two single stage Clariflow Thickeners were used in the Jones & Laughlin Steel Corporation Aliquippa Works for the following three jobs: (1) to remove over 95% of the settleable solids, (2) clarify the flow to less than five grains and (3) to thicken "mud" to within 40-50% for filtration.

Thickeners have inlet diffusers

The Clariflow Thickener is constructed for rugged use and is capable of overloading without work stoppage. It is provided with a multiple tangential inlet diffuser so that the flow of material entering the unit is uniformly diffused in a rotating manner.

"Short circuiting" at inlet prevented

Balanced rotation at the inlet of the Clariflow Thickener prevents short circuiting and the multiple weir troughs spaced over the entire rise area insure uniform slow rise to the surface of the water being clarified. This assures a clarified overflow containing the least amount of solids.

WRITE FOR BULLETIN 10I69

WALKER PROCESS

CLARIFLOW
thickeners

WALKER PROCESS WALKER PROCESS EQUIPMENT INC.
FACTORY • ENGINEERING OFFICES • LABORATORIES
AURORA • ILLINOIS

UNITED®

RENDLEMAN ROD MILL

HIGHER PRODUCTION RATE THAN ATTAINED ON ANY OTHER ROD MILL *

*

- **CONDITIONING OF BILLETS UNNECESSARY.**
- **FEWER ROLL CHANGES REQUIRED.**
- **LOWER ROLL and GUIDE MAINTENANCE COST.**
- **BETTER QUALITY RODS AT LOWER COST.**

UNITED *can serve you no matter where in the world you are.*

Designed and Built by

UNITED®

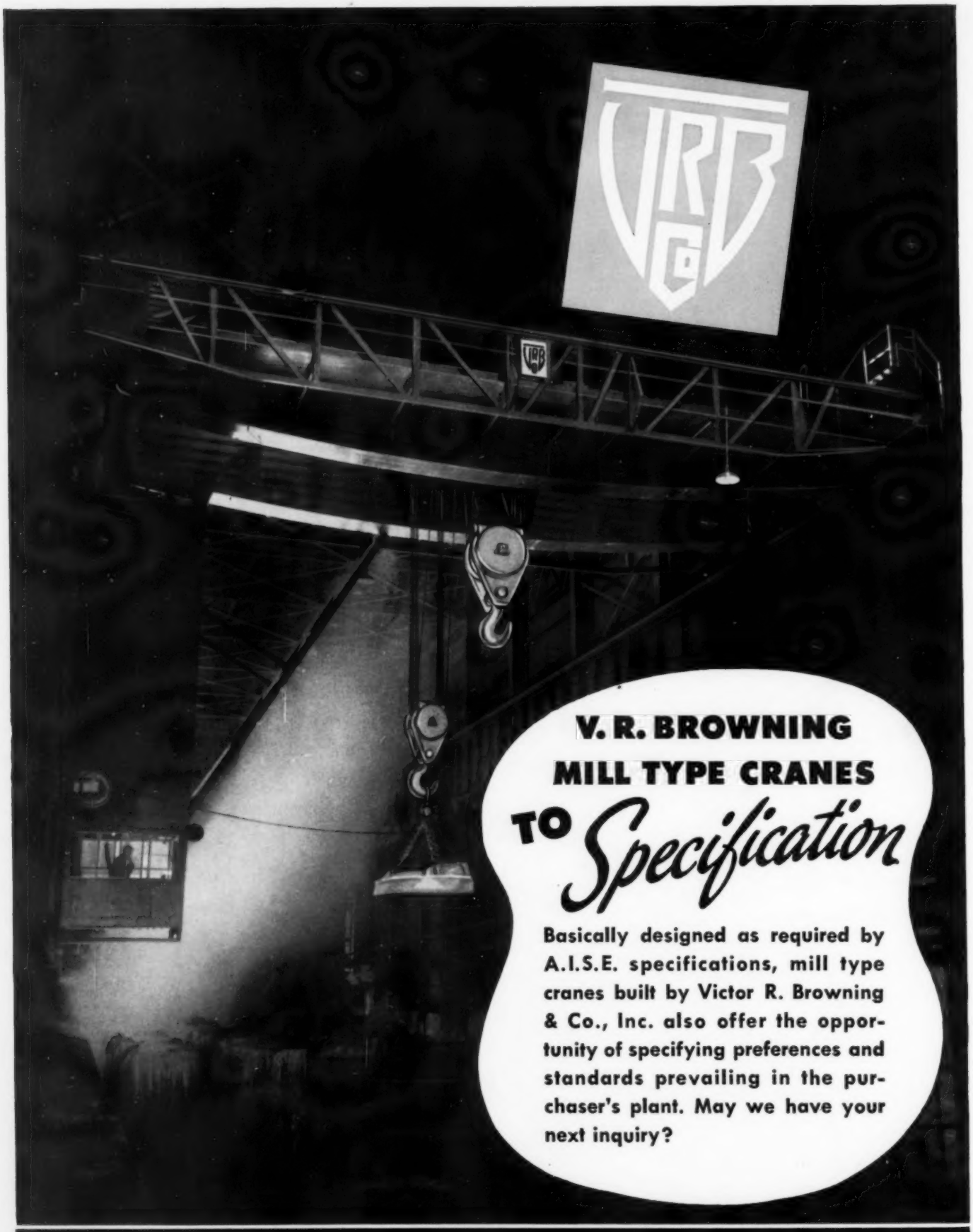
ENGINEERING AND FOUNDRY COMPANY

PITTSBURGH, PENNSYLVANIA

Plants at: PITTSBURGH • VANDERGRIFT • NEW CASTLE
YOUNGSTOWN • CANTON

Subsidiaries: ADAMSON UNITED COMPANY, AKRON, OHIO
LOBDELL UNITED COMPANY, WILMINGTON, DELAWARE
STEDMAN FOUNDRY AND MACHINE CO., INC., AURORA, INDIANA

Designers and Builders of Ferrous and Nonferrous Rolling Mills, Mill Rolls, Auxiliary Mill and Processing Equipment, Presses and other Heavy Machinery. Manufacturers of Iron, Nodular Iron and Steel Castings, and Weldments.


V. R. BROWNING
MILL TYPE CRANES
TO Specification
Basically designed as required by A.I.S.E. specifications, mill type cranes built by Victor R. Browning & Co., Inc. also offer the opportunity of specifying preferences and standards prevailing in the purchaser's plant. May we have your next inquiry?

VICTOR R. BROWNING & COMPANY, Inc.

BOX 309, WILLOUGHBY (CLEVELAND), OHIO

Designers and Builders of Electric Overhead Traveling Cranes and Hoists and Electric Revolving Cranes

The WHO...
WHAT...
WHY...
WHEN...
and WHERE

on how you can

Save up to 8%

by specifying

PENNSYLVANIA STANDARD PARTS POWER TRANSFORMERS

2500 Kva, Three Phase.
34400-1247Y/7200 volts.

who Can Use Pennsylvania Standard Parts Power Transformers?

Practically all utilities and industrials can use Pennsylvania Standard Parts Power Transformers because the electrical ratings and accessories are in accordance with NEMA Standards and proposed ASA-Standards C57.12a. To meet a wider range of system requirements, variations are permitted both in accessories and in electrical characteristics.

what Are Pennsylvania Standard Parts Power Transformers?

They are single or three phase Power Transformers, now manufactured in sizes up to 10,000 Kva and up to 69 Kv. Transformers are "Standard" when they conform to standard voltage ratings and are equipped with standard accessories in standard locations. For such transformers a full discount of up to 8% is applied. When voltages are other than standard, but within a certain voltage rating, slightly lower discounts are applied.

why Do Standard Parts Power Transformers Sell for Less?

Because quantity production methods of manufacturing, coupled with the use of standard designs and standard parts, shorten engineering and production time which, in turn, reduces the price of the transformer by as much as 8%.

when Can Deliveries Be Made on Standard Parts Power Transformers?

As a rule, deliveries of Standard Parts Power Transformers will be at least six to eight weeks faster than deliveries of special transformers. In some sizes, however, deliveries may be made even sooner.

where Can More Information on Standard Parts Power Transformers Be Obtained?

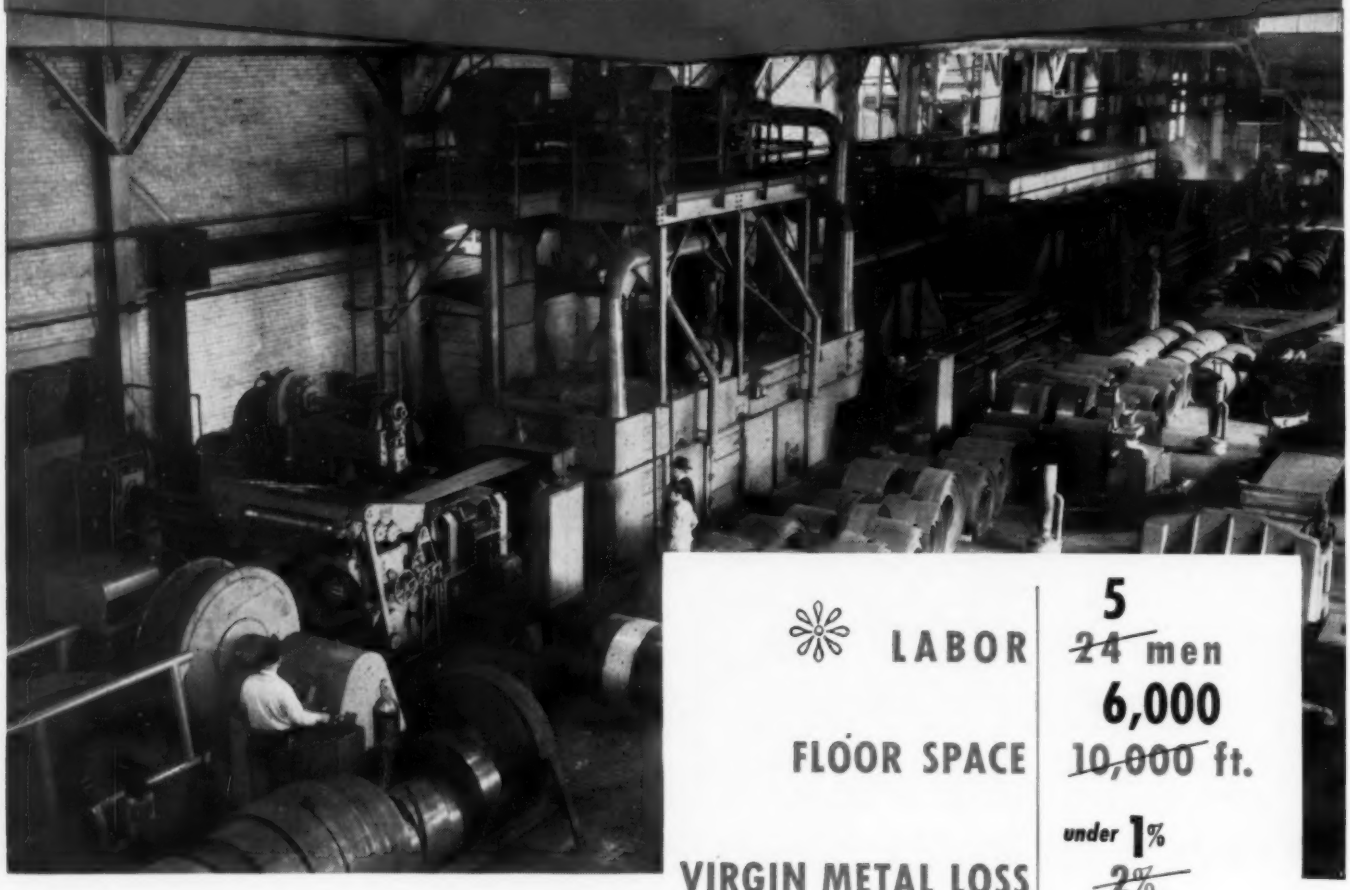
By contacting the Pennsylvania Transformer Representative in your area or by writing to Pennsylvania Transformer Company, Box 330, Canonsburg, Pa.

pt **PENNSYLVANIA TRANSFORMER COMPANY**

A McGraw Electric Company Division

CANONSBURG • PA.

COSTS SLASHED by a WHEELABRATOR® at ALLEGHENY LUDLUM STEEL CORP. in the DESCALING of STEEL STRIP



LABOR	5 ~~24~~ men
FLOOR SPACE	6,000 ~~10,000~~ ft.
VIRGIN METAL LOSS	under 1% ~~2%~~
SCALE BREAKING	NONE

The cost of descaling hot-rolled stainless steel strip has been drastically cut at the West Leechburg plant of Allegheny Ludlum Steel Corp. Chief cost saver is the elimination of scale breaking on straight chrome grades.

In addition, five men can now operate the Wheelabrator descaling line compared to 24 men for the batch pickling operation which it replaced. It requires only about 6,000 sq. ft. of floor space against 10,500 sq. ft. for pickling. The loss of virgin metal has been eliminated and the scale removed is in an easily recoverable condition. Weight loss varies according to grade but the average is well under 1%. This compares with a metal loss of 2% in pickling. A large reduction has been made in the amount of acid used which has helped their acid disposal problem.

The Wheelabrator is cleaning stainless steel strip in widths ranging from 9" to 37½" at speeds from 35′ to 75′ per minute. However, it may be applied to the cleaning of low carbon steels with equal success at any desired speed.

Savings that result from mechanical descaling of steel strip are described in bulletin 894. Send for your copy today.

WHEELABRATOR — The perfected airless centrifugal blast unit pioneered by American scours away scale and dirt mechanically at low cost. Provides a more uniform etch for mill rolls, effects unusual economies in cleaning strip, sheet, bar stock and skelp.

American
WHEELABRATOR & EQUIPMENT CORP.
396 S. Byrkit St., Mishawaka, Indiana

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST CLEANING EQUIPMENT

By MELVIN NORD, Patent Attorney, Detroit, Mich.

Patent Reviews

. . . . copies of patents may be obtained from the Commissioner of Patents, Washington 25, D. C., at 25 cents each . . . . patents reviewed cover period March 24 through April 14, 1953 . . . . .

APPARATUS FOR MAKING SLAB OR BILLET-TYPE INGOTS

▲IT has long been the common practice in the steel industry to cast steel ingots in integral cast iron molds, although this procedure has several serious shortcomings. Because of the tendency for steel splashings to stick to the side of an iron mold, it is necessary to apply a special coating to the walls of the mold. It is also considered necessary to taper the walls of the molds to facilitate stripping of the ingots and to control shrinkage losses. Stripping of the ingot is especially difficult at unusually high temperatures, as there is a tendency for the ingot to stick to the mold. Furthermore, the portions of the molds coming into contact with molten metal deteriorate rapidly.

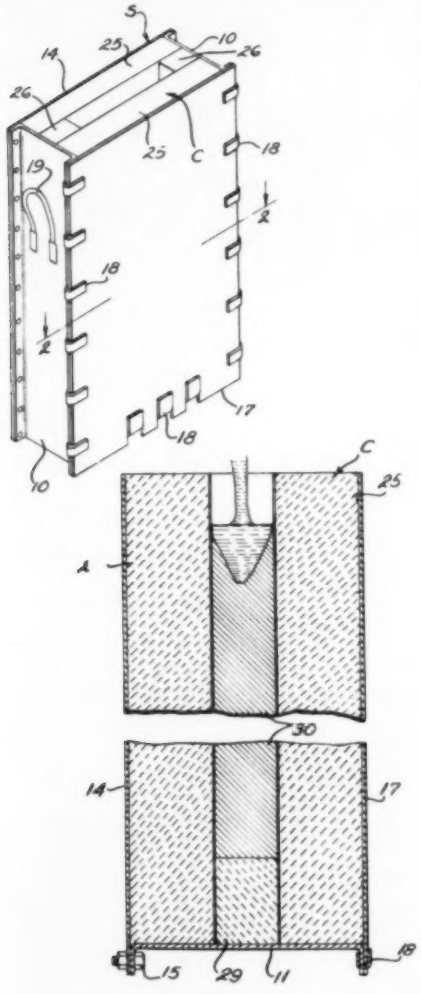


Figure 1

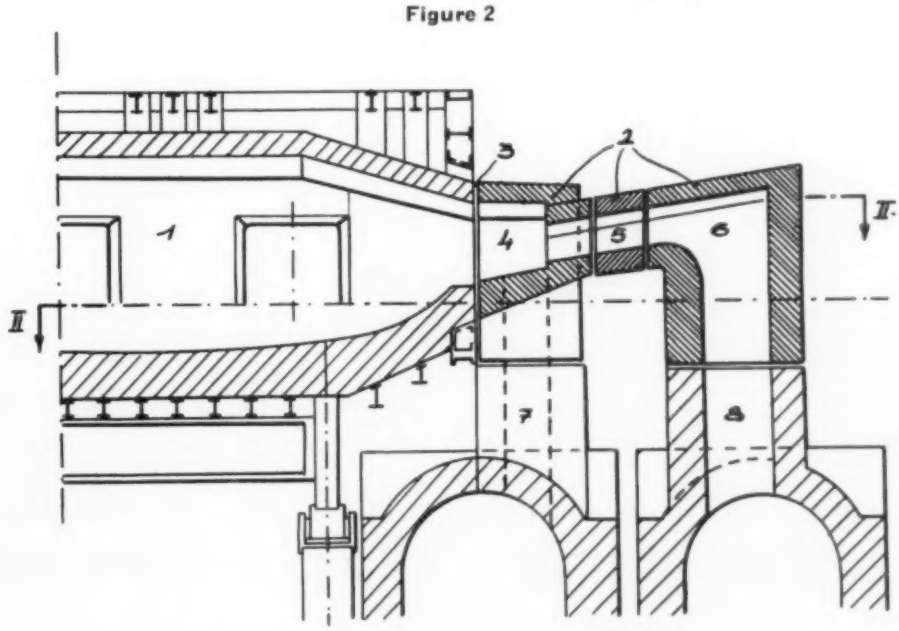
In U. S. 2,632,216, issued March 24, 1953, Harry W. McQuaid discloses a novel type of mold which eliminates the problems mentioned above and also permits the elimination of hot tops. It is also claimed that the new mold provides more rapid freezing and removal of the ingot, that the ingots are cast to close tolerances, and that the life of the molds are substantially increased.

As shown in Figure 1, the ingot mold consists of a fabricated sheet metal shell S, with a fabricated carbon liner assembly C defining a mold cavity of a predetermined size and shape. In order to obtain the desired effects, (1) the shell and liner assembly together should weigh at least twice as much as the molten metal to be poured, (2) the inner walls 25 should be parallel and not more than 3 inches apart, and (3) the ratio of total number of cubic inches in the mold cavity to the total number of square inches of molten metal contact surface area should not exceed 1.5. According to Mr. McQuaid, when these conditions are satisfied it is possible to pour vertical ingots of any practical height with less than 10 per cent of discard, because piping is practically eliminated even in killed steel. The width and height of the cavity may be of any practical dimensions (within the above limitations on weight and surface), but the mold cavity is critically thin in order to obtain the rate of chilling and freezing desired.

HEAD FOR REGENERATIVE FURNACES

▲U. S. 2,634,115 relates to the heads of regenerative furnaces of the tilting

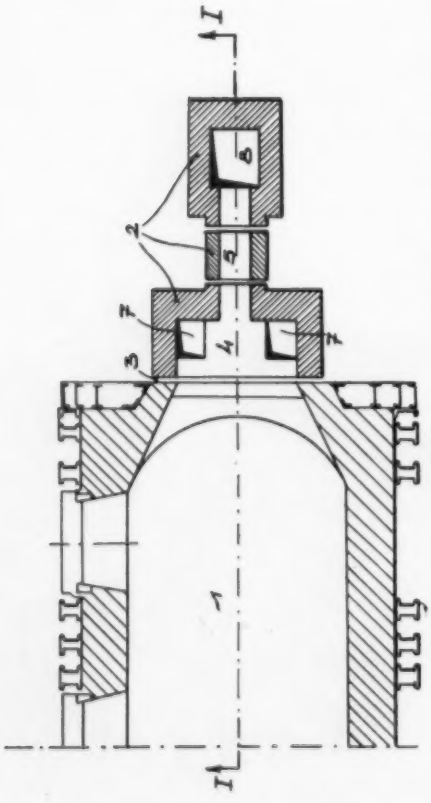
Figure 2



and mixing type. The inventors are Franz Barter and Hans Steyrleitner. The patent, issued on April 7, 1953, is assigned to General Refractories Co.

As shown in Figures 2 and 3, the head is composed of individual parts 4 and 6, which are arranged above the vertical air and gas flues 7 and 8, respectively, the parts being removable and replaceable independently of each other. Part 5, the part of the flue between the above-mentioned parts 4 and 6, is also separately removable and replaceable. It is claimed that the joint between the melting kettle and the head is in the part of the furnace which is the least worn by erosion of the gases. Furthermore, the joint is in a zone of super-atmospheric pressure, so that cold air is not sucked into the joint as in the usual design. Subdividing the head of the furnace results in a considerable reduction of weight of each of the replaceable parts, thus avoiding the need for expensive conveying and lifting devices.

Figure 3



CHECKER BRICKWORK FOR REGENERATOR

▲IN U. S. 2,634,118, issued April 7, 1953 to Emil Jantsch and assigned to O. F. Gayton, an improved type of checker brickwork is described for use in regenerators such as open-hearth furnaces and blast furnace stoves.

As shown in Figures 4 and 5, the checker brickwork is supported on an arch 11, providing a gas or air space 12 at the bottom of the chamber. A side wall is indicated by the numeral 10, and a bridge wall as 13. The checker work is of the straight lattice or ventilated type, and is built of a number of uniformly dimensioned bricks of the type shown in Figure 5. The bricks are so constructed that when two of them are placed end to end, the bearing surfaces 17 of a third brick placed crosswise on them will have firm bearing on the inner ends of the first two bricks.

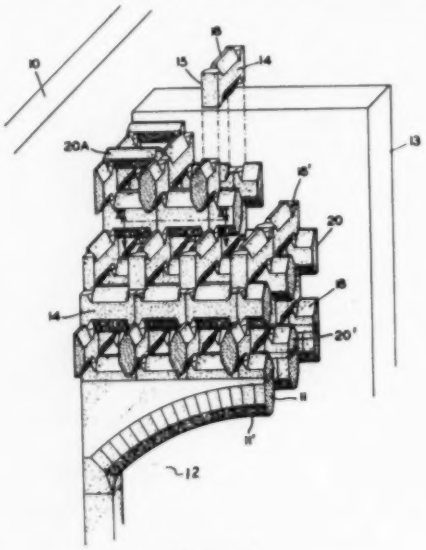


Figure 4

The checker work so produced provides a series of vertical column-like essentially square openings for the passage of gas or air. There is no change in the effective cross-sectional area of the columnar passage as the fluid flows up or down through the checker work. This is regarded as important, since it greatly reduces the flow resistance, and prevents the existence of dead spots where debris may collect. A certain amount of eddying is produced adjacent to the surface of the columnar passages, thereby improving heat transfer without a corresponding increase in pressure drop.

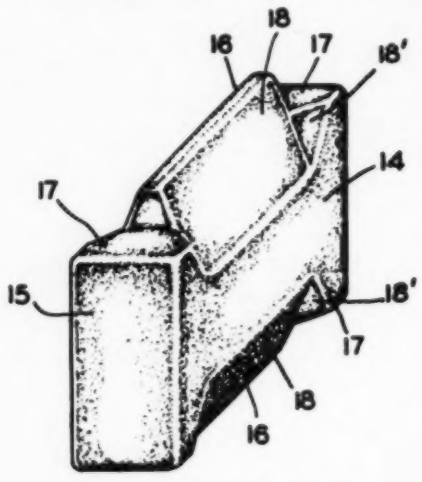


Figure 5

OTHER PATENTS OF INTEREST TO THE IRON AND STEEL ENGINEER

Patent No.	Date	Subject	Inventor or Assignee
2,632,347	3/24/53	Lubricant for metal rolling mills	Standard Oil Development Co.
2,632,641	3/24/53	Tiltable traction wheel for feeding strip to rolling mills	United States Steel Corp.
2,632,711	3/24/53	Preparation of a hydraulic cement from blast furnace slag	Victor Trief
2,632,718	3/24/53	Descaling of ferrous metal articles	William Isler
2,633,094	3/31/53	Power-operated press for forging, extruding, or drawing metals	E. W. Bliss Co.
2,633,234	3/31/53	Die block for wire drawing machines	Western Electric Co., Inc.
2,633,306	3/31/53	Guide for loading bundles of wire or rod on payoff reels	United States Steel Corp.
2,633,420	3/31/53	Austenitic alloy irons and steels	Karl Spitz
2,633,450	3/31/53	Tin and tin alloy plating bath	United States Steel Corp.
2,633,633	4/ 7/53	Brazing of austenitic ferrous alloys	Ford Motor Co.
2,633,708	4/ 7/53	Control for hydraulic presses	American Steel Foundries
2,634,144	4/ 7/53	Means for securing rolls to shafts	The National Machinery Co.
2,634,205	4/ 7/53	Low alloy steel of high yield strength	Crucible Steel Co. of America
2,634,635	4/14/53	Rolling mill	Erwin Loewy
2,634,694	4/14/53	Suspended arch tile structure for furnaces	M. H. Detrick Co.
2,634,964	4/14/53	Conveyor furnace for annealing stainless steel	The Cold Metal Products Co.
2,635,044	4/14/53	Hardenable stainless steel alloy	The Cooper Alloy Foundry Co.
2,635,062-3	4/14/53	Apparatus for continuous cleaning of metal strip	Kolene Corp.
2,635,064	4/14/53	Metal cleaning method	Kolene Corp.
2,635,073	4/14/53	Removal of phenol from contaminated waste ammonia liquors	Jones & Laughlin Steel Corp.

ROTARY SHEAR?

no, this is a Rotary Shear

THIS Morgan shear can cut bars up to 3 sq. in. cross section area at speeds up to 3000 F. P. M. The opening and closing of the knives is performed hydraulically, dispensing with the use of magnetic clutches and brakes, thereby eliminating all "creep" and slippage. The action is positive and precise. The "V" shape cutting edge of the knives leaves no "beard" or slivers where the cut is made. Here we show twin shears for double strand rolling.

Do you have a rolling mill problem? We would like to work it out with you.

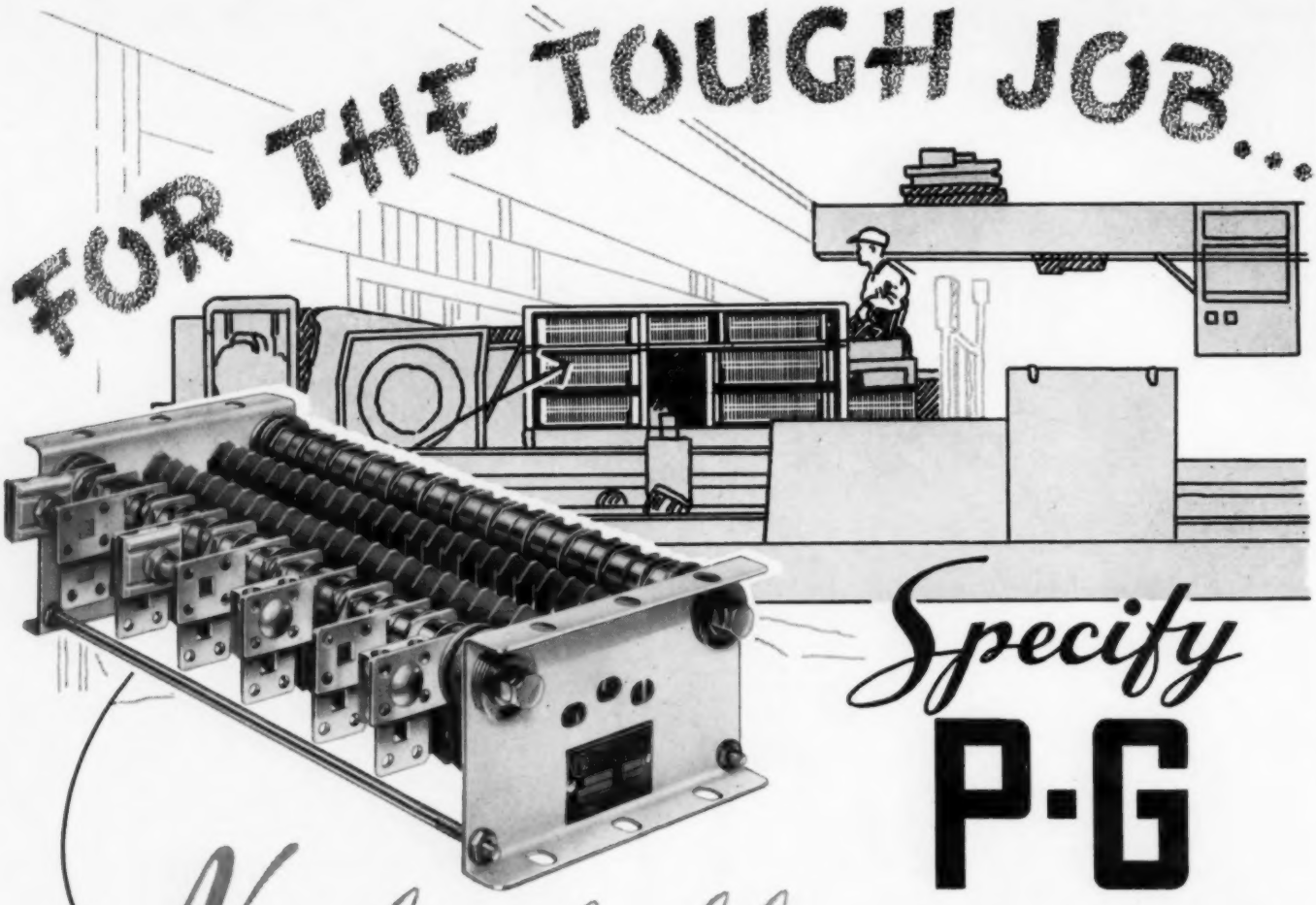
MORGAN CONSTRUCTION CO.
WORCESTER, MASSACHUSETTS

English Rep., International Construction Co., 56 Kingsway, London W. C. 2, England

ROLLING MILLS • MORGOIL BEARINGS • WIRE DRAWING MACHINES
REGENERATIVE FURNACE CONTROLS • EJECTORS • GAS PRODUCERS

RM-80

FOR THE TOUGH JOB...



Specify

P-G

Nonbreakable **RESISTORS**

Built of steel and mica, there is nothing delicate or fragile about a P-G Resistor. When used for the troublesome jobs that seem to plague every maintenance department, continuous Trouble-Free Service may be expected.

P-G Resistors are not affected by vibration set up by various kinds of mobile steel mill equipment. Neither are they harmed by moisture laden or corrosive atmospheres. In addition there is provision for expansion coupled with adequate ventilation to dissipate the heat of operation.

Complete data in BULLETIN No. 500 Copy on request

Often, after one test installation in that tough spot, P-G Steel Grid Resistors are specified not only for repair and maintenance replacements but for new work as well.

P-G

The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI 2, OHIO

Extra Tonnage every hour... WITH PERMANENTE 165!

Reports from leading steel producers using Permanente 165 ramming mix for open hearth bottoms show that:

Many furnaces are "tripling"... original tap holes are lasting up to 80 heats without repiping . . . production records are being broken, with extra tonnage every hour.

Chances are that the proved superiority of a Permanente 165 bottom, based on records of scores of furnaces, can boost *your* open hearth production well above current rates.

Such performance is possible because patented Permanente 165 is a high MgO *periclase* ramming material derived from sea water magnesia of highest purity.

Pre-shrunk and accurately sized periclase grains assure a bottom of great volume stability—another of Permanente 165's more than *20 quality advantages.*

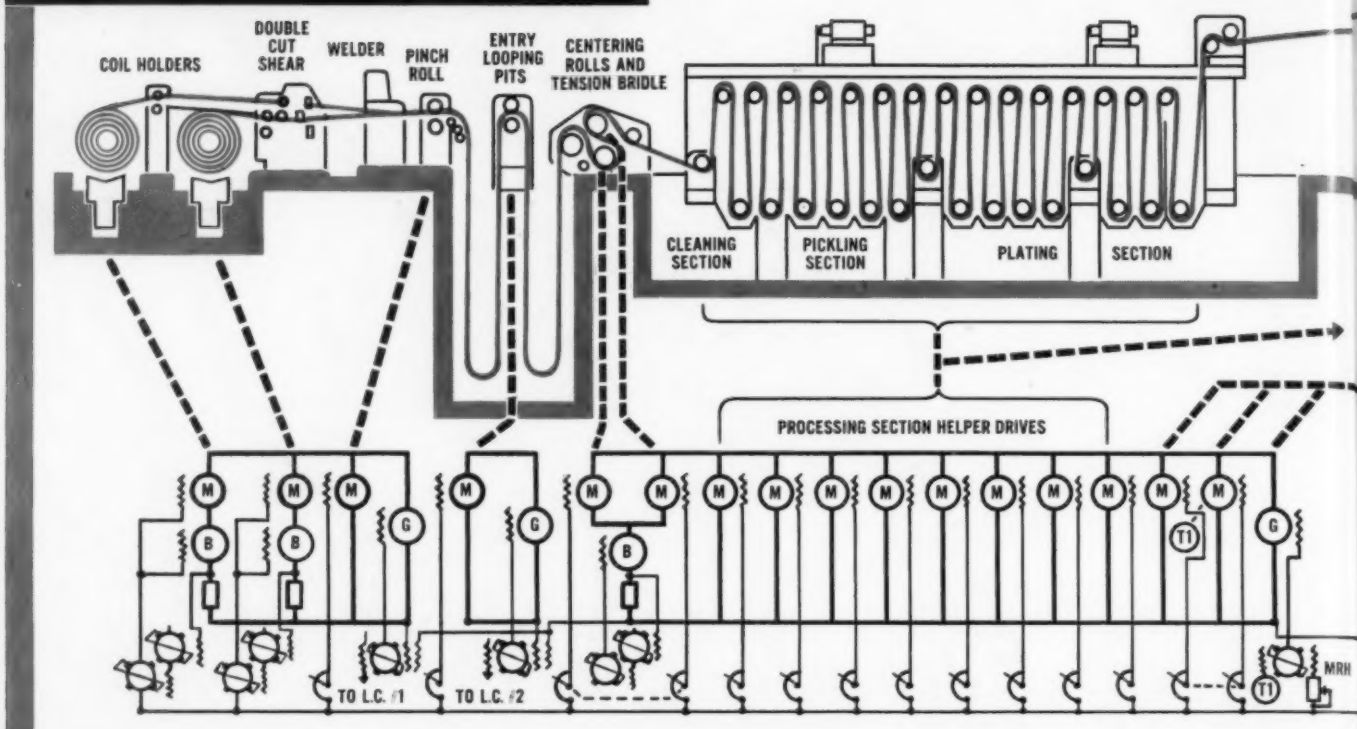
SEND FOR LITERATURE giving *all* the important advantages of Permanente 165 and the companion material, Permanente 84. Upon request, your Kaiser refractory engineer will promptly offer you research, design and installation service to help you obtain more steel tonnage per year, at lower bottom cost per ton. Call or write principal sales offices: *Chemical Division*, Kaiser Aluminum & Chemical Sales, Inc., 1924 Broadway, Oakland 12, California. First National Tower, Akron 8, Ohio.

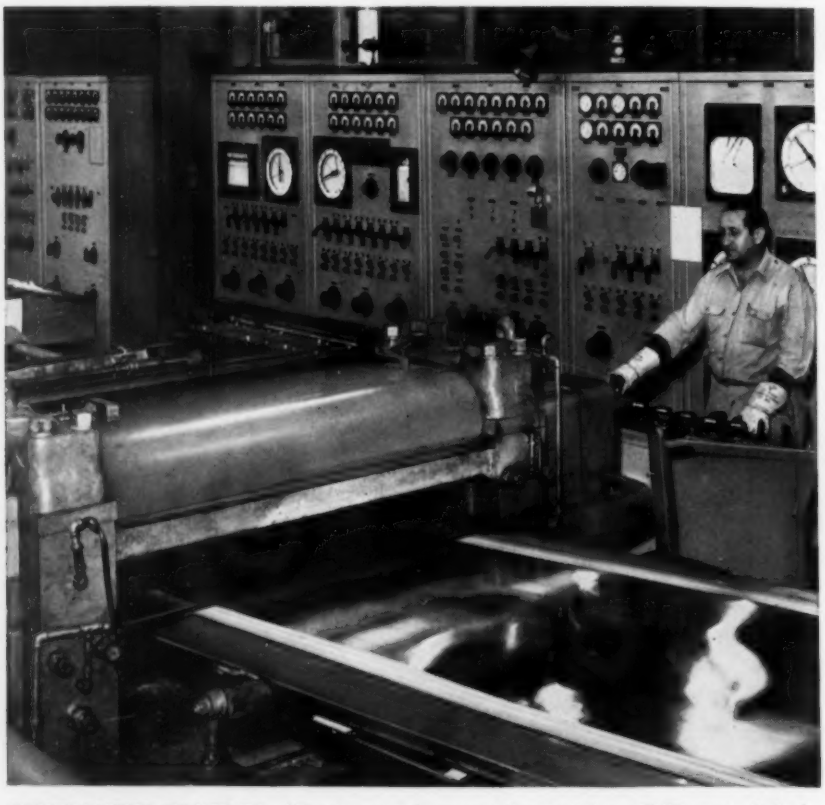
Kaiser Chemicals

Pioneers in Modern Basic Refractories

Basic Refractory Brick and Ramming Materials • Dolomite • Magnesia • Magnesite • Alumina • Periclase

ENGINEERING REPORTS:





CENTRALIZED CONTROL—Most operations are directed from G-E control desk.

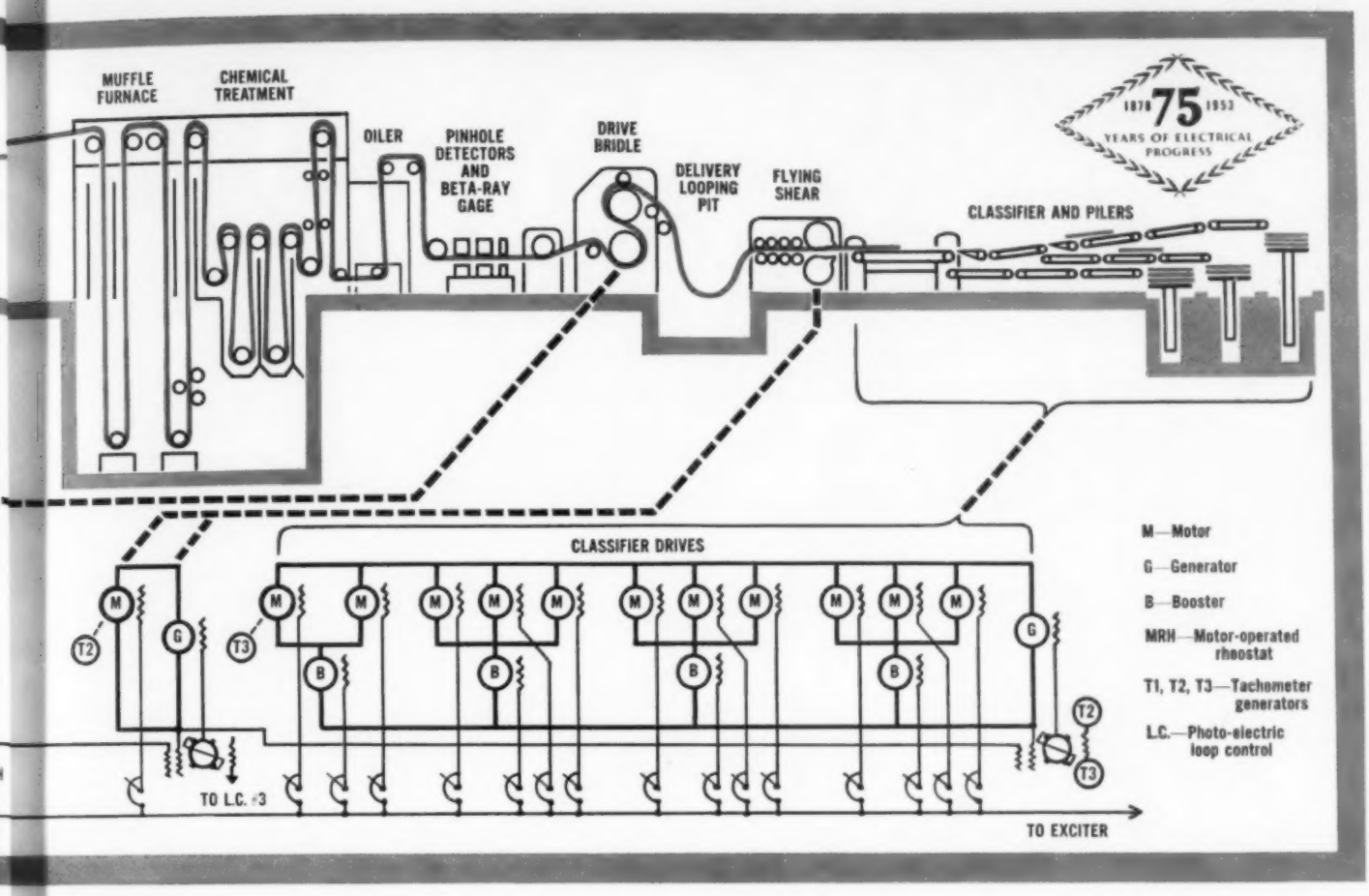
HOW THIS G-E DRIVE WORKS

Speed of the plating section is precisely controlled by an amplidyne which regulates the speed of the drive bridle to the preset speed setting of the main motor-operated rheostat. This rheostat provides a controlled rate of acceleration and deceleration for normal operations. In case of strip breakage, fast stopping is provided by the current-limit circuit, thereby reducing line-rethreading time to a minimum.

Amplidyne voltage regulators on each end-section generator set the speed of the particular section at approximately correct value by comparing section voltage with main plating-section voltage. The photoelectric loop controls act as over-riding verniers to maintain proper loop positions. The classifier generator, however, has a speed-control vernier which compares the speed of the shear with the speed of the classifier belts to maintain the proper speed relation between classifier belts and shear.

Plating-current control involves a high-precision photoelectric galvanometer designed to hold current within one per cent accuracy. The cleaning, pickling and chemical-treatment low-voltage generators and the two 1500-kva transformers supplying power to the muffle furnace are also accurately controlled.

Another example of G-E drive engineering at work!



World's fastest vertical acid tinning line assures uniform thickness, lower production costs

G-E drive system permits differential coating, improved quality control, shorter weld cycle

Kaiser Steel Corporation's automatic vertical acid tinning line at Fontana, Cal., built under license from U. S. Steel Corporation, operates at 1200 fpm, fastest speed to date for vertical acid tinning. To help make its high-speed operation continuous, G-E engineers worked with Kaiser Engineers and the Wean Engineering Company to design a precise co-ordinated drive system. Result:

Faster production: Amplidyne voltage regulators speed up drive acceleration and deceleration, cut weld-cycle time.

Tin conservation: Differential coating and precise plating-current control promise savings of 25 to 50 per cent.

Less plate damage: Improved electrical controls on sheet classifier help clear cobbles quickly without stopping line.

G-E steel-mill application engineers can help you solve your electrical drive and control problems. Contact your local G-E Apparatus Sales Office. General Electric Company, Schenectady 5, New York. 659-94

DEPENDABLE POWER is supplied to the tinning line through G-E motor-generator sets (center). Amplidynes regulate strip speed according to line operator's setting.

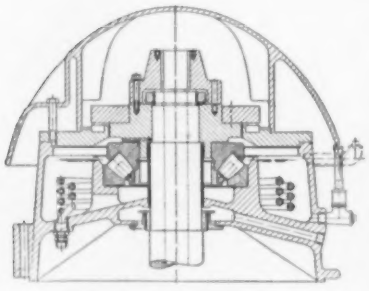
GENERAL ELECTRIC

Highest anti-friction capacity for VERTICAL SHAFT applications

The SKF Spherical Roller Thrust Bearing is becoming more and more popular as the means of supporting heavy thrust loads at high speeds. Vertical shaft applications demand bearing engineering which is abreast of the newest developments in equipment design.

Here is *why* the SKF Spherical Roller Thrust Bearing is earning increased application with manufacturers everywhere:

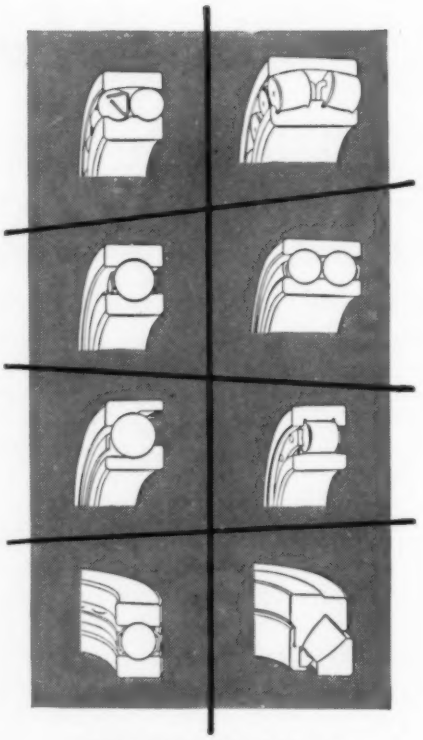
- The bearing has very high capacity for thrust loads, and combined loads which are predominantly thrust.
- It is fully self-aligning—has a single row of rollers which roll on a spherical outer race with full self-alignment.
- The bearing design is such that the lubricant is pumped outwardly against the inner ring high guide flange—thereby insuring perfect lubrication and long, trouble-free life.



The drawing shows a typical application of the SKF Spherical Roller Thrust Bearing—providing higher *capacity*, size for size, than any available design.

When you're laying-in anti-friction bearings, you can get design assistance and help from SKF Field or Home Office men who know the best ways to do the job in every industry. And, when you have a bearing replacement to make, call your SKF Distributor. 7435

SKF INDUSTRIES, INC., PHILA. 32, PA.,—*manufacturers of* **SKF** *and* HESS-BRIGHT *bearings.*



SKF'S COMPLETE LINE OF ANTI-FRICTION BEARINGS, PLUS **SKF** ENGINEERING CO-OPERATION, HELPS YOU *PUT THE RIGHT BEARING IN THE RIGHT PLACE.*

SKF®

BALL AND ROLLER BEARINGS

NATIONAL SA-SERIES MOTOR AND GENERATOR BRUSHES

TRADE-MARK

"NATIONAL" SA-series brushes were developed especially to provide a higher degree of uniformity in operation than was ever before achieved over a broad field of machines and service conditions. These brushes offer very closely controlled commutation characteristics and permit, with relatively few grades, a highly accurate, efficient brush application technique.

Many years of successful service, on all kinds of equipment and under widely divergent conditions, have *proved* the ability of this brush family to fulfill its objectives. Today, largely because of experience with the SA-series, electrical and maintenance men have come to expect . . . and they *get* . . . much more for their brush dollar all through the mill.

SA-35 . . . has both *good commutating ability* and *long life* for a wide range of motors and generators where heavy loads and high surface speeds are combined with normal commutating conditions.

SA-3538 . . . similar to SA-35 in load-carrying ability and commutation factor, but with distinctly different film-forming characteristics designed to prevent streaking and threading of the commutator under low average-load conditions.

SA-45 . . . unequalled for *ridability at high speeds* and *peak commutating performance;* especially adapted to extremely severe commutating conditions on the most difficult jobs.

It pays to know your "National" brush grades . . . and to look for them under the "National" trademark on every brush you use.

HOW GOOD IS REALLY GOOD BRUSH PERFORMANCE? Write National Carbon Company

The term "National", the Three Pyramids device, and the Silver Colored Cable Strand are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

District Sales Offices:
Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco

In Canada: NATIONAL CARBON LIMITED
Montreal, Toronto, Winnipeg

NATIONAL STANDARDIZED BRUSHES

BETTER— PRODUCT—PACKAGE—PRICE—FASTER

Research... cornerstone of advanced instrumentation

RESEARCH is a job that never ends. This holds particularly true in the field of instrumentation, for every advance in manufacturing procedures brings a demand for better techniques for measurement and control.

But research, to fulfill its true function, must do more than keep pace with progress. In Honeywell's Industrial Division, research points far beyond today's frontiers. Here, skilled scientists are intensively engaged in programs that are developing solutions not only for present problems, but also for the much more demanding applications of the future. Drawing on the related sciences of physics, electronics, metallurgy, chemistry and nucleonics, they are helping to bring instrumentation into its own as a new and essential science. Fundamental research, which attacks control problems in their most basic aspects, is supplemented by development studies to evolve practical equipment for factory use. Working in close cooperation with research, Honeywell application engineers translate new developments into working systems, custom-fitted to today's process requirements.

Covers all phases of control

Each of Honeywell's several laboratories works in specialized but related phases of instrumentation.

The primary elements laboratory, for example, searches into ways to improve the performance of today's elements—and to utilize the latest scientific discoveries in producing new detecting devices with greater range, speed, flexibility and accuracy.

In the precision measurement laboratory, Honeywell's own "Bureau of Standards" performs the most exacting electrical and mechanical measurements to provide precise evaluation of new developments.

The nuclear engineering laboratory develops specialized techniques of measurement and control essential to the nation's accelerated atomic energy program.

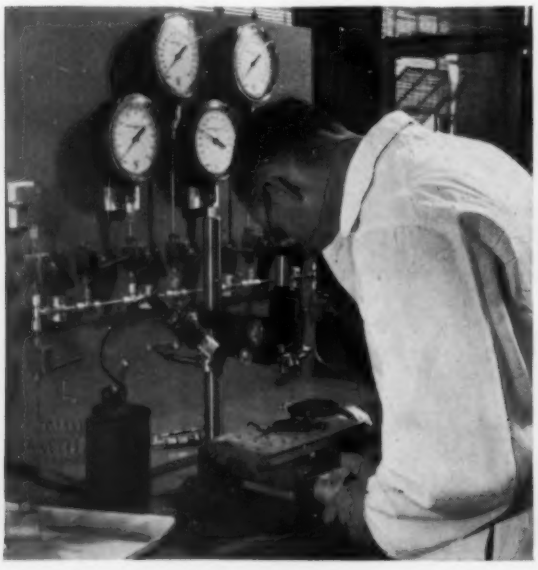
The servomechanisms laboratory studies the techniques which will be needed to control the "automatic factory" of the future . . . operates processes in miniature, and analyzes their control performance.

What of tomorrow?

To the instrument user—in factory or laboratory—Honeywell's research has twofold significance. It assures continued refinement of instrumentation for the measurement and control work that's to be done today. And it promises new and revolutionary equipment from Honeywell . . . "First in Controls" . . . for the increasingly important role that instrumentation will play in tomorrow's world.

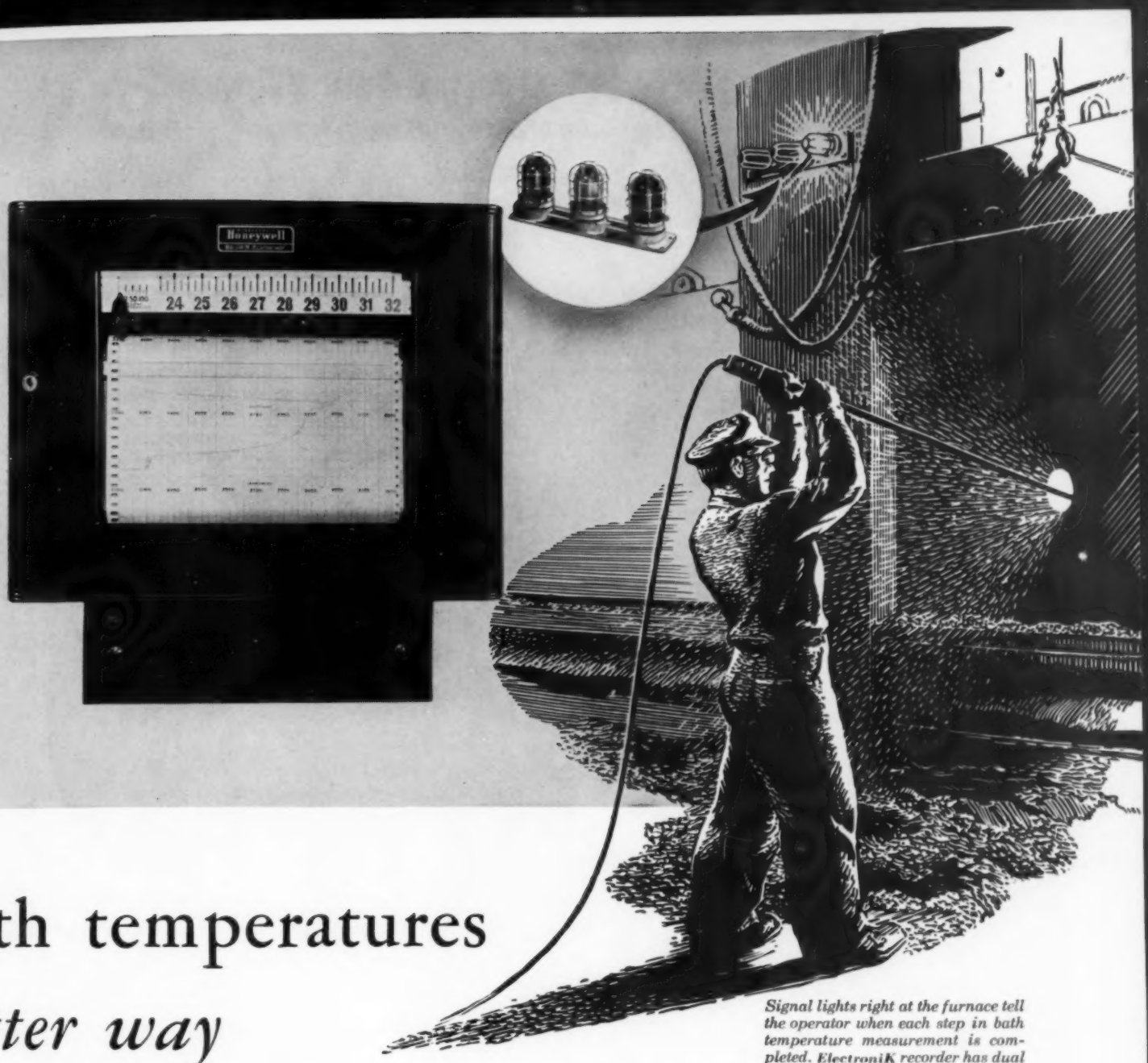
Now— measure

this easier,



PRECISION MEASUREMENTS *aid study of new pressure measuring elements.*

NEW CONTROL TECHNIQUES *are developed in the servomechanisms laboratory.*



bath temperatures *better way*

Signal lights right at the furnace tell the operator when each step in bath temperature measurement is completed. ElectroniK recorder has dual scale for ambient and bath temperatures...automatically switches range.

NEW AUTOMATIC signalling features incorporated in the *ElectroniK* recorder now bring greater simplicity and economy to the measurement of steel bath temperatures by the immersion thermocouple method. Integral signalling circuits in the recorder actuate remote color-coded lights near the furnace, to tell the operator when:

. . . thermocouple is properly connected and in operating condition.
. . . instrument is standardized and ready to record.
. . . thermocouple is preheated to correct temperatures.
. . . recorder pen has reached actual bath temperature.

The operator can make a complete measurement on signalled information alone . . . doesn't need to consult the *ElectroniK* recorder, which can be located remote from the furnace.

Thermocouples last longer, because the operator leaves the element in the molten bath only long enough to get an accurate reading, as indicated by his signal lights. This operating feature, in a typical installation, paid for the entire instrument cost in a single day's operation.

The *ElectroniK* signalling recorder is equally applicable to measurements in the furnace or in the spoon. Our local engineering representative will be glad to discuss how this instrument can improve the accuracy, speed, and economy of bath measurements in your shop. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4464 Wayne Ave., Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Instrumentation Data Sheet No. 6.7-8a.**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Fully Crowned Tooth Design Can Be Used To Solve Your Long-Standing Coupling Problem

A major improvement in gearing for power transmission—a fundamental improvement in gear tooth design that practically eliminates all "end tooth and tip" contact and provides greater freedom of axial movement distinguishes Amerigear Couplings from common gear-type couplings. Amerigear Couplings offer many more advantages than are obtainable with the common basic designs. The Amerigear Crowned Tooth Design can be applied wherever couplings are required. There are many instances where this design has been utilized to simplify power transmission mechanisms and add reliability to their performance in a measure heretofore found impossible.

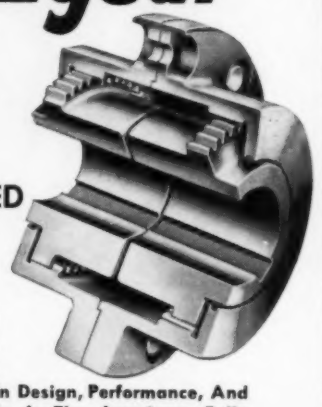
If your problem arises from excessive offset or angular misalignment, tight back lash requirement, space limitations, high speeds and loads, or any combination of these, the solution is best made by the utilization of the Amerigear Fully Crowned Tooth. Amerigear engineers are available for consultation.

AMERICAN FLEXIBLE COUPLING COMPANY
ERIE, PA., U. S. A.
Originator of the Amerigear Fully Crowned Tooth
Sales Offices in Principal Industrial Centers
Affiliate J. A. ZURN MFG. CO.
In Canada: CANADIAN ZURN ENGINEERING, LTD.
2052 ST. CATHERINE ST. W., MONTREAL 25 P. Q., CANADA

Amerigear*

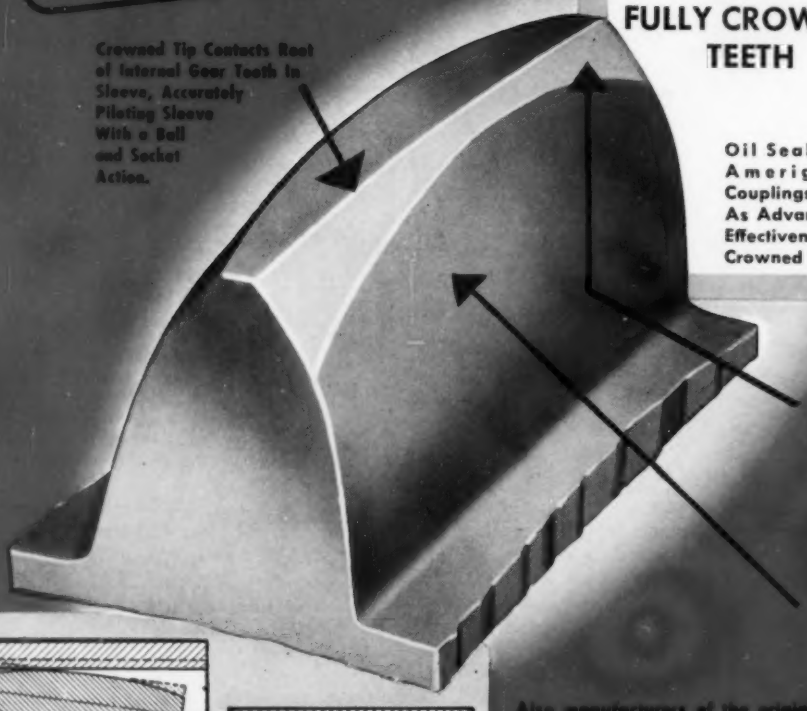
*Trade Mark Reg.

THE ONLY GEAR TYPE COUPLING WITH FULLY CROWNED TEETH

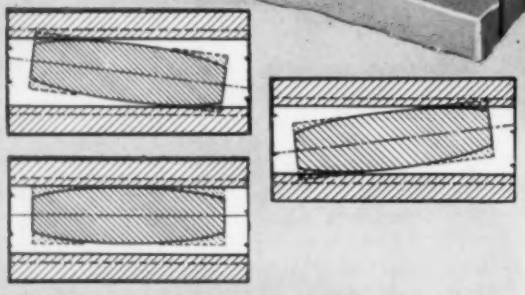


Oil Seals of Amerigear Couplings Are As Advanced In Design, Performance, And Effectiveness As Is The Amerigear Fully Crowned Tooth. Pat. & Pat. Pending

Amerigear
Fully Crowned Tooth Design Solves Wide Range of Power Transmission Problems.


Crowned Tip Contacts Root of Internal Gear Tooth In Sleeve, Accurately Piloting Sleeve With a Ball and Socket Action.
Chamfered to Eliminate Interference With Sleeve of Tooth Fillet and Allow Contact on True Flank of Gear Tooth.
Crowned Flank Carries All the Load and Provides for Correction of Lateral and Angular Misalignments When Required.

Also manufacturers of the original "Oldham Type" American Flexible Coupling



Comparison Of Amerigear Fully Crowned Tooth Design With Gearing Of Conventional Gear-Type Couplings Shows How "End Tooth And Tip" Contact Is Practically Eliminated And Why Greater Freedom Of Axial Movement Is Provided By Amerigear Fully Crowned Tooth Design (dotted lines indicate gear teeth of conventional gear-type coupling).

Copyright 1953

AMERICAN FLEXIBLE COUPLING COMPANY
ERIE, PA., U. S. A.

Please send me further information regarding AMERIGEAR COUPLINGS with the fully Crowned Teeth and Catalog No. 501.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Please attach to your business letterhead

for heat treating pipe

ihp*

SAVES MATERIALS

NEARLY 1,500,000 POUNDS OF MANGANESE AND MORE THAN 300,000 POUNDS OF MOLYBDENUM WERE SAVED

. . . in five years by this Selas pipe treating installation. No previous heat treating practice provided continuous quenching and drawing . . . no other production method fully developed the physical properties of plain carbon steel pipe . . . no other process permitted a substitution for the normalized, high alloy steel formerly used to meet specifications.

Two things made such a substitution possible . . . first, new concepts of heating and quenching; and second, new furnace designs which made such concepts workable and practical. Combined, Selas engineering and equipment for this and other Gradiation processes provide *Improved Heat Processing,* a symbol of Selas progress in furnishing heat for industrial purposes.

To the savings in materials, add those in time, working and storage space, handling, pickling, and product quality improvement, and you have a more complete story of what *Improved Heat Processing* can do for you. Write Selas when you need heat for such mill processes as:

HEATING STRIP, BILLETS, BARS, PIPES, SLABS OR WIRE
PRODUCTION FORGING OR HEAT TREATING
MELTING OR EXTRUDING

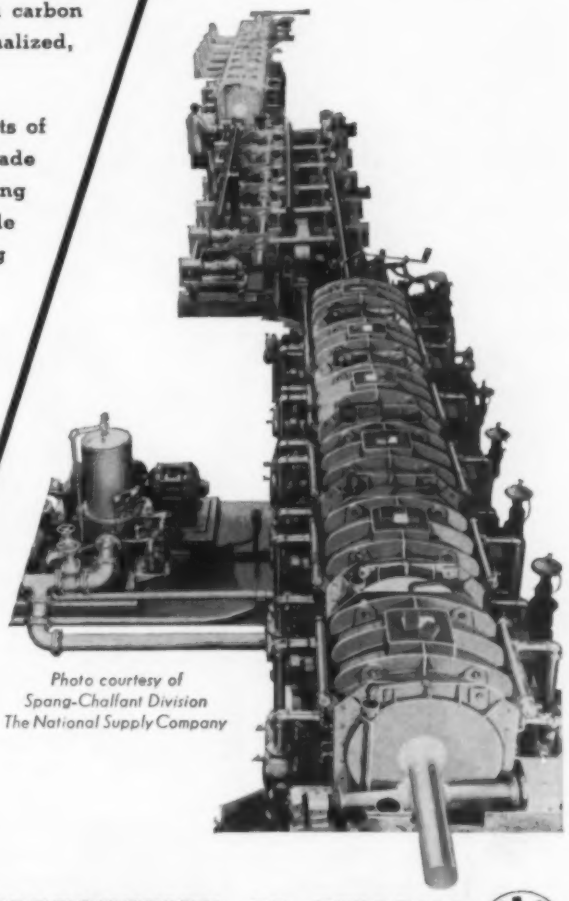


Photo courtesy of Spang-Chalfant Division The National Supply Company

***Improved Heat Processing**

SELAS

CORPORATION OF AMERICA
PHILADELPHIA 34, PENNSYLVANIA

Heat Processing Engineers for Industry • Development • Design • Manufacture

RUST-OLEUM®

STOPS RUST!

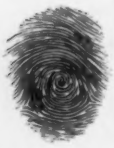
Resists Rain, Snow, Heat, Fumes, Weathering, Salt Water, etc.

Rust-Oleum *saves* preparation, *saves* manhours! Just scrape and wirebrush to remove rust scale and loose particles . . . then brush Rust-Oleum 769 Damp-Proof Red Primer *directly over the sound rusted surface*. Rust-Oleum finish coatings in many colors, aluminum, and white provide *double protection*. Specify Rust-Oleum for new construction, maintenance, or re-modeling. Prompt delivery from Industrial Distributor stocks in principal cities.

RUST-OLEUM CORPORATION
2442 Oakton Street, Evanston, Illinois

FREE SURVEY: Ask a Rust-Oleum specialist to conduct a survey including actual applications, tests, and recommendations. No cost or obligation. See Sweets for nearest Rust-Oleum distributor or write for literature today.

There is only one Rust-Oleum . . .



Distinctive as your fingerprint, Rust-Oleum is an *exclusive formula* created and developed by a Master Mariner during more than 20 years of battling actual rust-producing conditions at sea. It incorporates a specially-processed fish oil vehicle that will *dry*, is *odor-free*, and is formulated in many *colors*, *aluminum*, and *white*. Specify genuine Rust-Oleum. Accept no substitute.

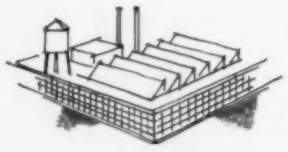
Practical, economical answer to your rust problems . . .

Sandblasting, chemical pre-cleaning and other costly preparations are not usually required as Rust-Oleum 769 Damp-Proof Red Primer may be applied *directly over sound rusted surfaces* after scraping and wirebrushing to remove rust scale and loose particles.

Brush, dip, or spray—available in many colors . . .

Beautify . . . as you protect with Rust-Oleum finish coatings available in a wide variety of colors. They incorporate the same basic rust-inhibiting vehicles and provide greater compatibility and *double protection*.

Proved throughout industry for over 25 years . . .



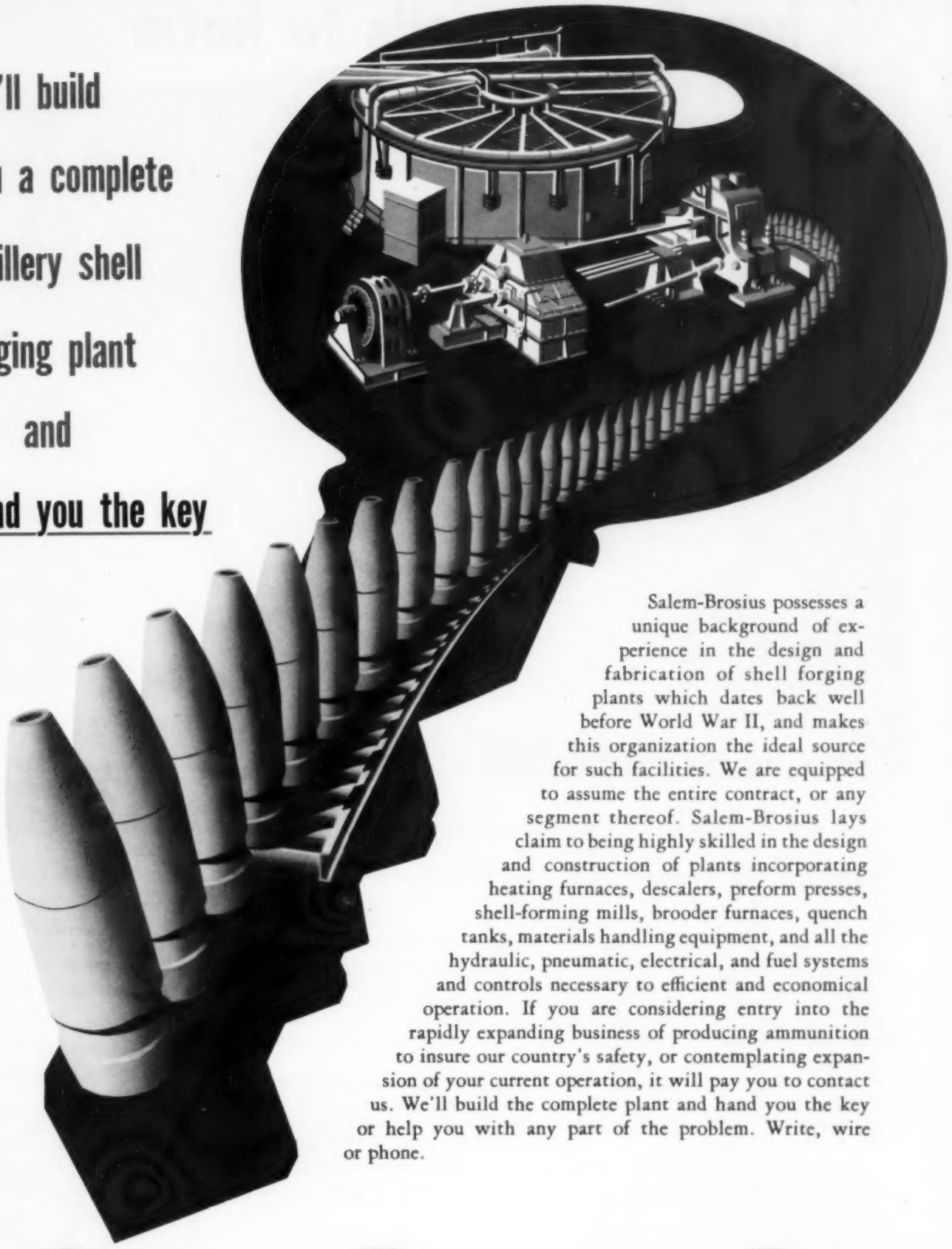
Leading companies throughout the world, in nearly every type of industry, have proved Rust-Oleum's capacity to resist rain, sun, snow, heat, fumes, salt water and salt spray, many acids and chemicals.

ATTACH TO YOUR LETTERHEAD—MAIL TODAY!

RUST-OLEUM CORPORATION
2442 Oakton St., Evanston, Illinois

- ☐ Have a Qualified Representative Call
- ☐ Free Survey
- ☐ Complete Literature
- ☐ Nearest Source of Supply

We'll build you a complete artillery shell forging plant and hand you the key



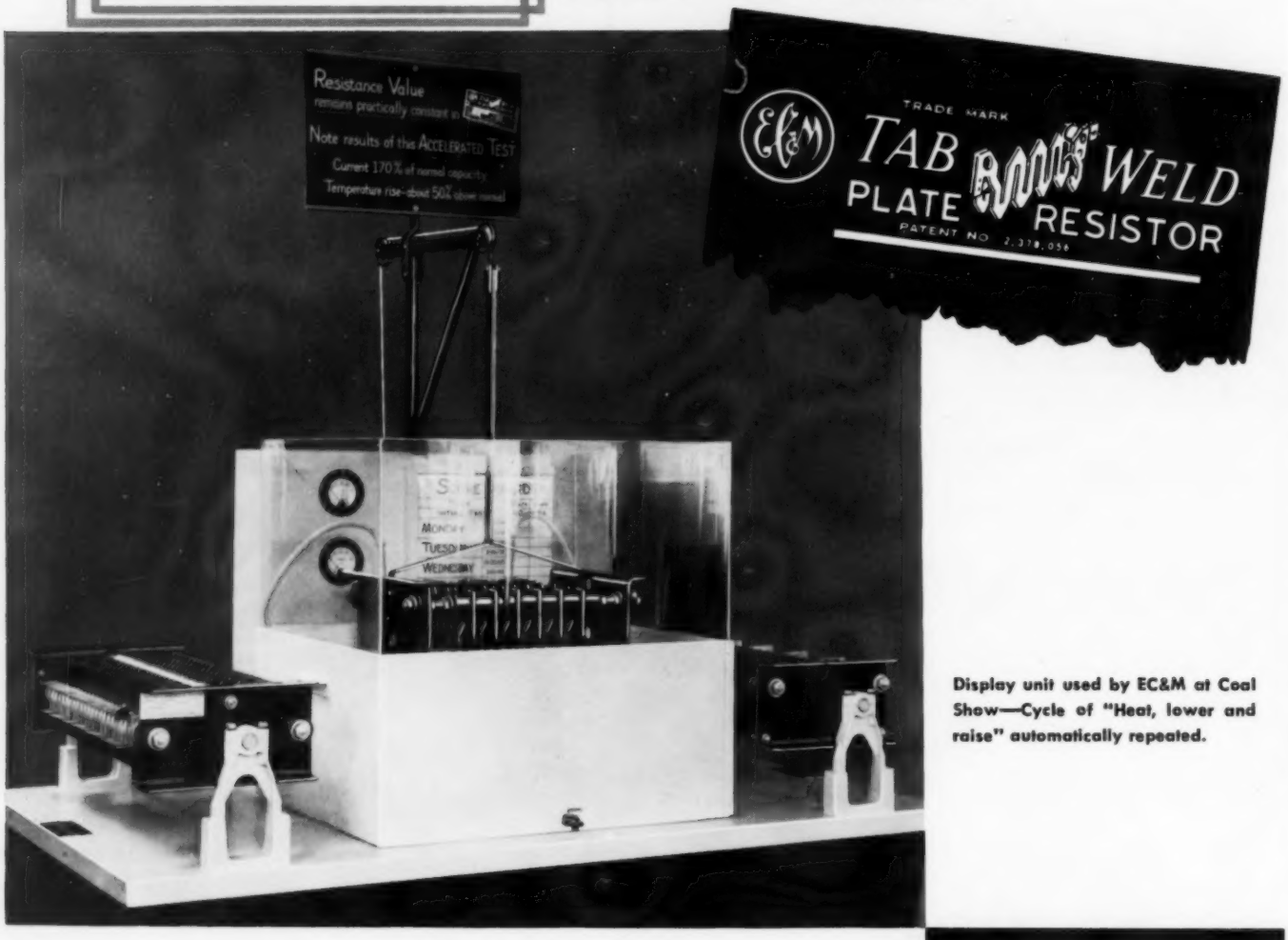
Salem-Brosius possesses a unique background of experience in the design and fabrication of shell forging plants which dates back well before World War II, and makes this organization the ideal source for such facilities. We are equipped to assume the entire contract, or any segment thereof. Salem-Brosius lays claim to being highly skilled in the design and construction of plants incorporating heating furnaces, descalers, preform presses, shell-forming mills, brooder furnaces, quench tanks, materials handling equipment, and all the hydraulic, pneumatic, electrical, and fuel systems and controls necessary to efficient and economical operation. If you are considering entry into the rapidly expanding business of producing ammunition to insure our country's safety, or contemplating expansion of your current operation, it will pay you to contact us. We'll build the complete plant and hand you the key or help you with any part of the problem. Write, wire or phone.

SALEM-BROSIUS, INC.

Sales and Executive Offices: 248 Fourth Avenue, Pittsburgh 22, Pa.

Brosius Division, Pittsburgh 15, Pa. • Salem Engineering Division, Salem, Ohio

harsh test fails to harm



Display unit used by EC&M at Coal Show—Cycle of "Heat, lower and raise" automatically repeated.

section OVERHEATED and quickly cooled in water about 1000 times—and no failure of any part

The severest service application would never subject a resistor-bank to the test given the above 100-ampere (continuous-rating) EC&M TAB-WELD Resistor section. Heating was accelerated by applying current 70% above normal, causing temperature to rise about 50% above rated rise in a short time. The resistor was then quickly immersed in water. Repeated about 1000 times, this EC&M TAB-WELD Section operated without attention.

Ohmic value was the same at the end of the test as at the beginning—the current-carrying path remained intact—no tightening of end-clamping nuts was needed—there was no burning at grid eyes or at tap plates.

For topmost efficiency in resistors for starters, controllers, battery-charging panels, test-panels, smoke precipitators and similar applications, investigate EC&M TAB-WELD Plate Resistors. Bulletin 942 gives complete facts. Write for a copy.

TEST DATA

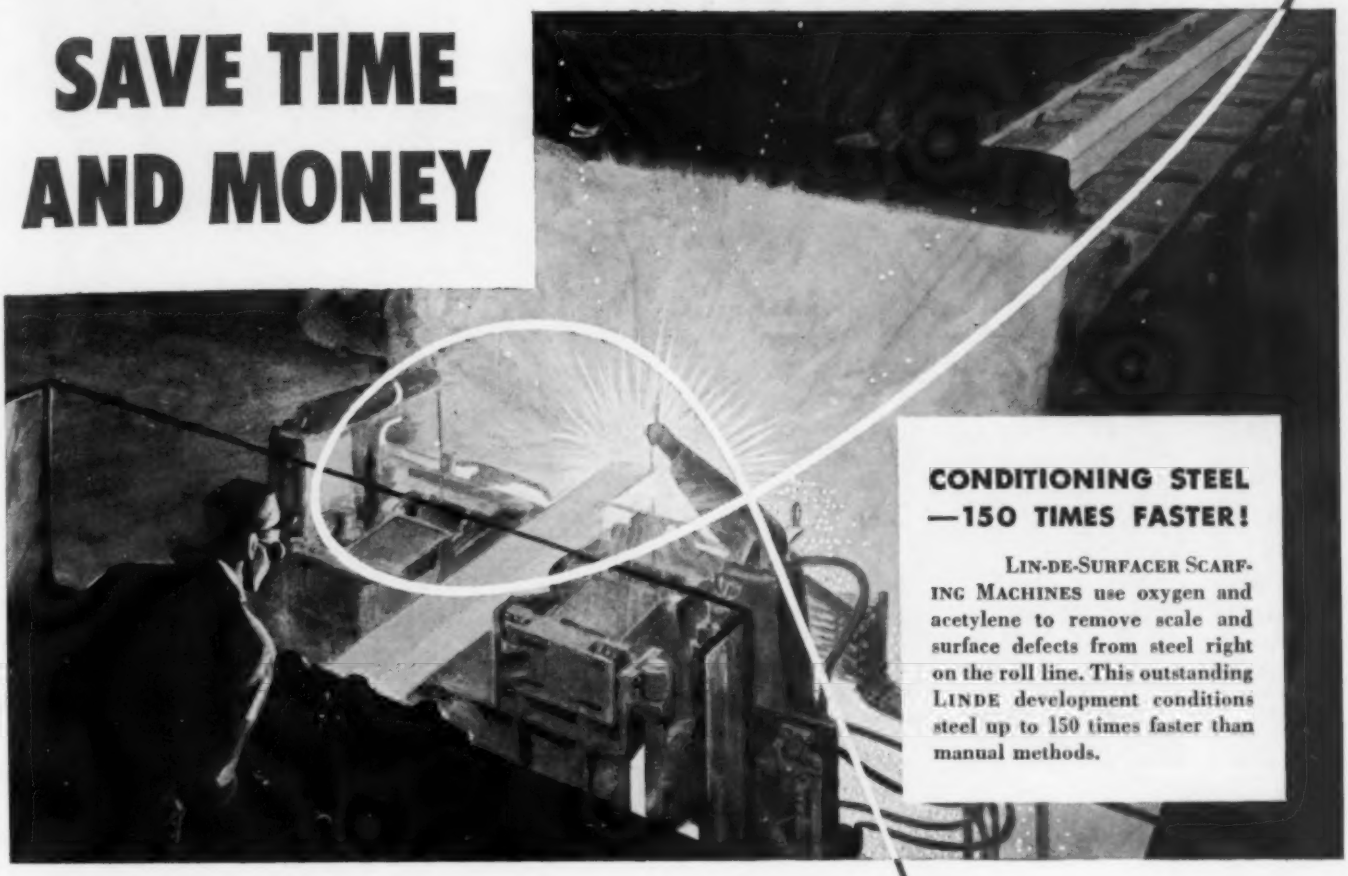
Ohms at start	.244
Ohms after 1000 operations	.245
Current used (average)	170 amps.

Temperature of resistor about 550° C. before immersion

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

How Oxygen...and LINDE SERVICE*

SAVE TIME AND MONEY



CONDITIONING STEEL —150 TIMES FASTER!

LIN-DE-SURFACER SCARFING MACHINES use oxygen and acetylene to remove scale and surface defects from steel right on the roll line. This outstanding LINDE development conditions steel up to 150 times faster than manual methods.

LINDE Oxygen Customers get the advantage of...

LINDE'S MANY PLANTS, strategically located to assure a dependable supply, meet every demand. No oxygen failure due to failure of a single plant.

LINDE'S DRIOX and CASCADE Oxygen Systems, which have no fixed capacities. Even under widely fluctuating demands, your supply is determined by your needs. You pay only for what you use.

LINDE'S FIELD ENGINEERS, who work on oxygen users' problems —help them find new and better ways to get the most economy and efficiency from their use of LINDE oxygen.

LINDE'S LABORATORIES, which are constantly working on new and improved applications for oxygen. Many of today's oxygen-using methods and machines are the result of LINDE research and development.

If your company uses oxygen, LINDE SERVICE *can mean dollar savings to you. Let us tell you more about it.*

LINDE AIR PRODUCTS COMPANY

A Division of UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street UCC New York 17, N. Y.

Offices in Principal Cities

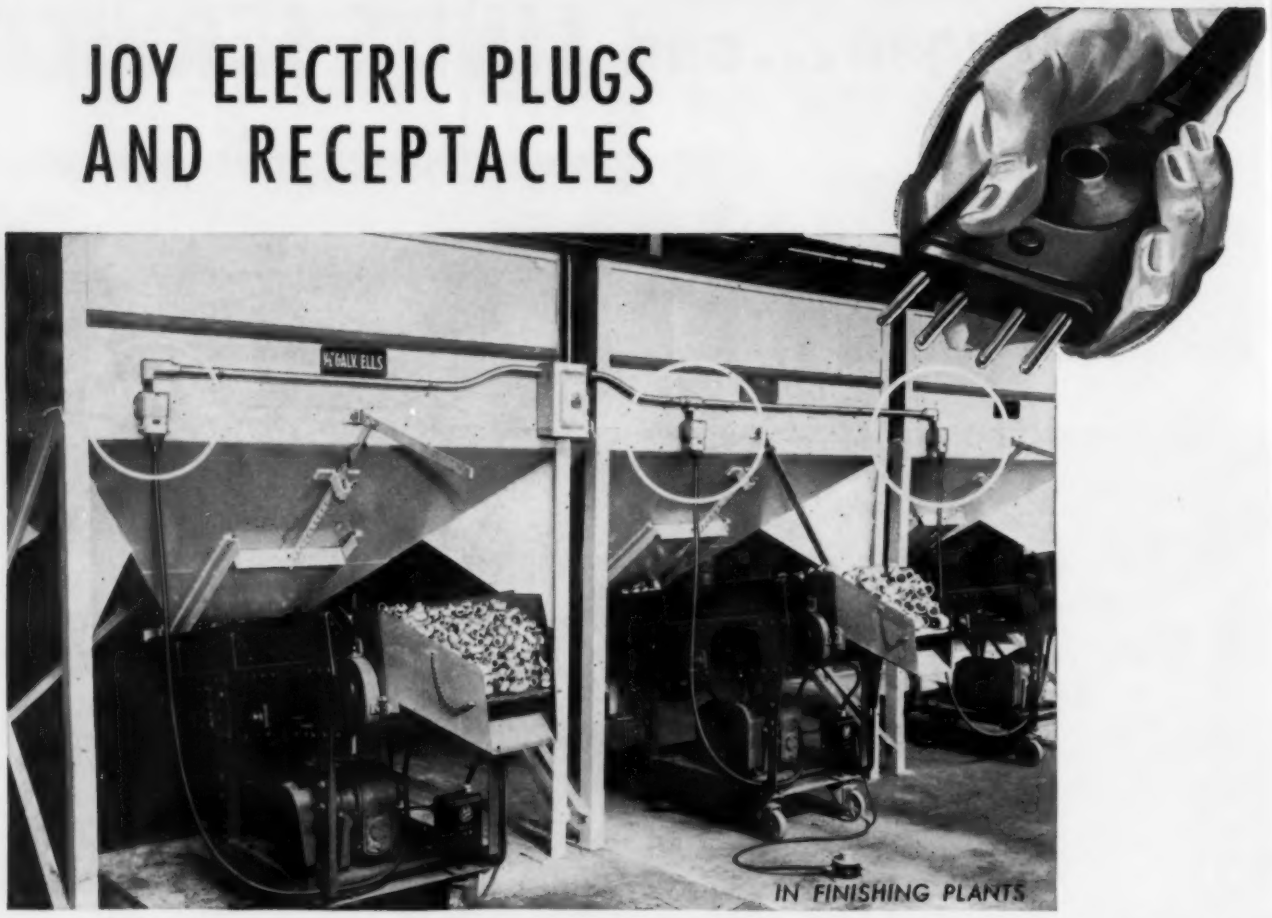
In Canada: Dominion Oxygen Company, Limited, Toronto

AND * LINDE SERVICE

which is the unique combination of all of the research, engineering, and over 40 years of accumulated know-how that is helping LINDE customers save money and improve production in their uses of oxygen and oxy-acetylene processes.

Linde

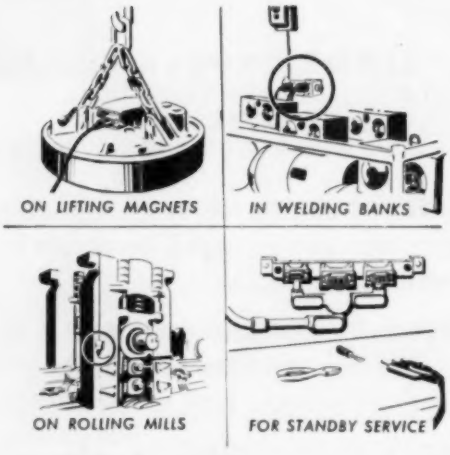
JOY ELECTRIC PLUGS AND RECEPTACLES



IN METAL PROCESSING PLANTS . . . STEEL MILLS ROLLING MILLS & FOUNDRIES

To earn the OK of Heavy Industry, electrical plugs and receptacles must function perfectly for long periods under conditions that quickly destroy many types now available for general industrial needs. That's our reason for believing the growing use of JOY connectors in metal processing plants, steel mills, rolling mills and foundries should be of particular interest to you. We're sure you'll want to know more about their inherent advantages (*see next paragraph*) before placing your next electrical connector order.

Factory molded to cable as one-piece Neoprene units, JOY connectors are little affected by rough handling, hard blows, grime, oil, moisture or vibration. Once installed, little or no maintenance is required. Available in designs and capacities to meet almost any portable power connecting requirement. Why risk electrical connector misfits when today's best actually costs less, in the long run. Full details including free literature available without obligation. Ask for them, today!



Consult a Joy Engineer

- ☆ *FACTORY MOLDED AS ONE-PIECE NEOPRENE UNITS*
- ☆ *SHATTER-PROOF, MOISTURE-TIGHT, WEAR-RESISTANT*
- ☆ *HIGHLY RESISTANT TO SUNLIGHT — OIL AND ACID*
- ☆ *EASILY INSTALLED — PROVIDE YEARS OF SERVICE*

. . . MORE THAN 100 YEARS OF ENGINEERING LEADERSHIP

M. E. 1151.1

JOY MANUFACTURING COMPANY

HENRY W. OLIVER BUILDING, PITTSBURGH 22, PENNSYLVANIA

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LTD., GALT, ONTARIO

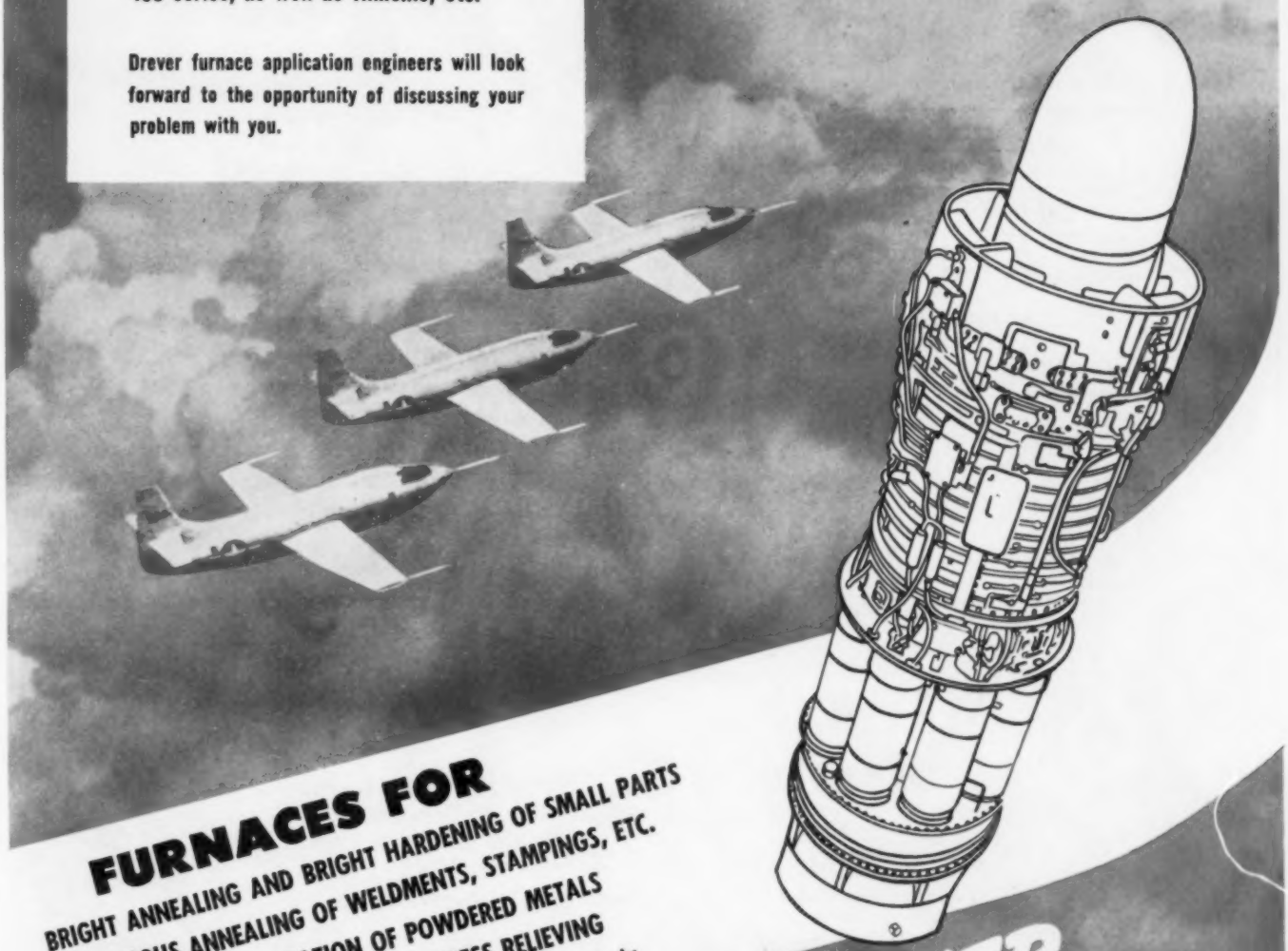
Heat Treating

AN IMPORTANT FACTOR IN MAKING

Jet Engine Parts

The parts that go to make up a jet engine call for heat treating techniques as new as they are varied. Drever's long experience, through its own commercial heat treating division, has provided welcome solutions to many new problems of furnace design encountered in this field. Drever builds heat-treating furnaces of many types, with special adaptability to treating Stainless Steels of the 300 and 400 series, as well as Nimonic, etc.

Drever furnace application engineers will look forward to the opportunity of discussing your problem with you.



FURNACES FOR

BRIGHT ANNEALING AND BRIGHT HARDENING OF SMALL PARTS
CONTINUOUS ANNEALING OF WELDMENTS, STAMPINGS, ETC.
SINTERING AND INFILTRATION OF POWDERED METALS
BATCH OR CONTINUOUS TYPE FOR STRESS RELIEVING
Also installations for caustic descaling including quench and acid dip tanks

DREVER CO.

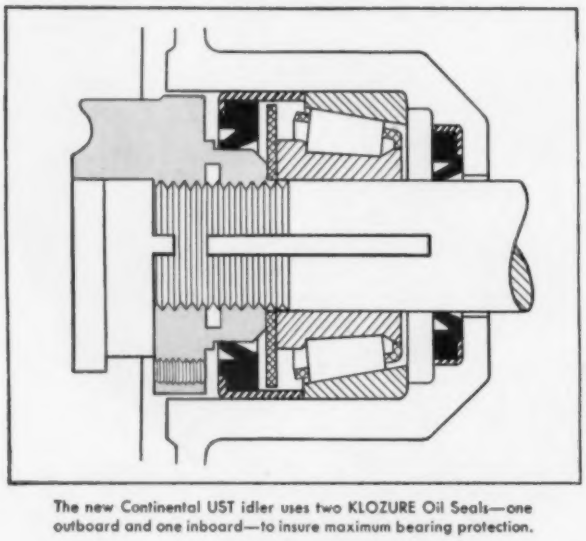
730 E. VENANGO STREET
PHILADELPHIA 34, PA.

8

New Continental Idler operates 1, 2, 3, or more years without relubrication . . .

WITH THE HELP OF KLOZURE*

Oil Seals



The new Continental UST idler uses two KLOZURE Oil Seals—one outboard and one inboard—to insure maximum bearing protection.

This UST factory-sealed belt conveyor idler, developed by The Continental Gin Company, was designed primarily to cut maintenance costs and insure a longer life for both the belt and idler assembly. Continental engineers wanted an idler that would operate satisfactorily without re-lubrication for one, two, three, or more years. That's why they chose a pre-lubricated sealed unit incorporating tapered roller bearings and dependable KLOZURE Oil Seals.

Garlock KLOZURES protect the bearings on Continental idlers by keeping the lubricant *in*, the dirt and moisture *out*. In addition, the KLOZURE assembly prolongs belt life by preventing the leakage of grease on to the belt.

For positive bearing protection specify KLOZURE Oil Seals for your machinery. KLOZURES are made in many models and in a complete range of sizes.

Write for Klozure Catalog No. 10.

Model 71-A Springless KLOZURE, the inboard seal

Model 71-A-7 Springless KLOZURE, the outboard seal

*REGISTERED TRADEMARK

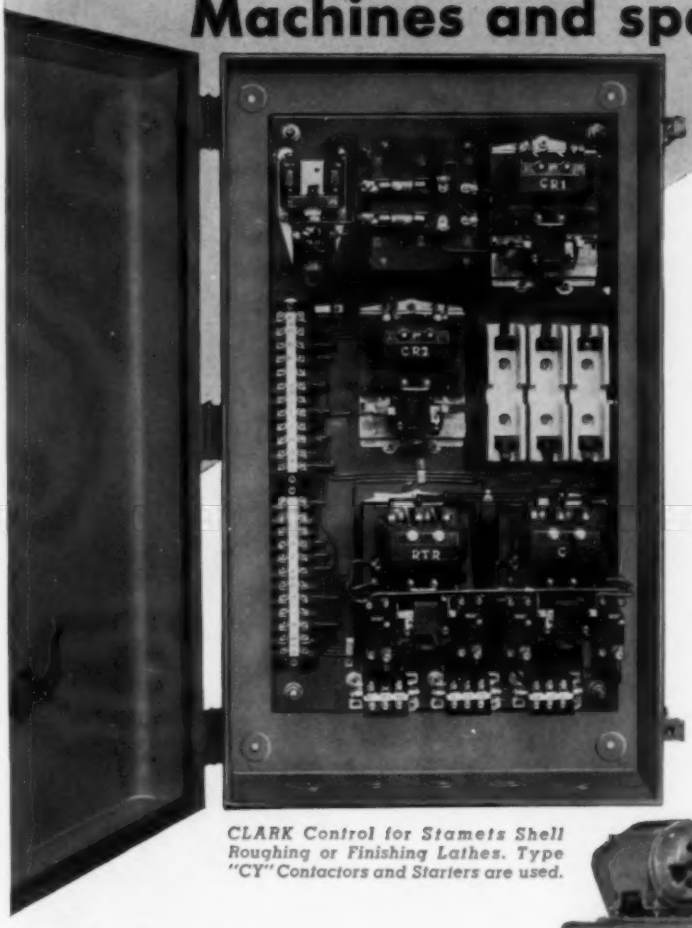
THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.
Branch Offices in Most Principal Cities

GARLOCK

**PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS,
RUBBER EXPANSION JOINTS**

CLARK TYPE "CY" STARTERS

efficiently control STAMETS Heavy-Duty Machines and speed shell production!



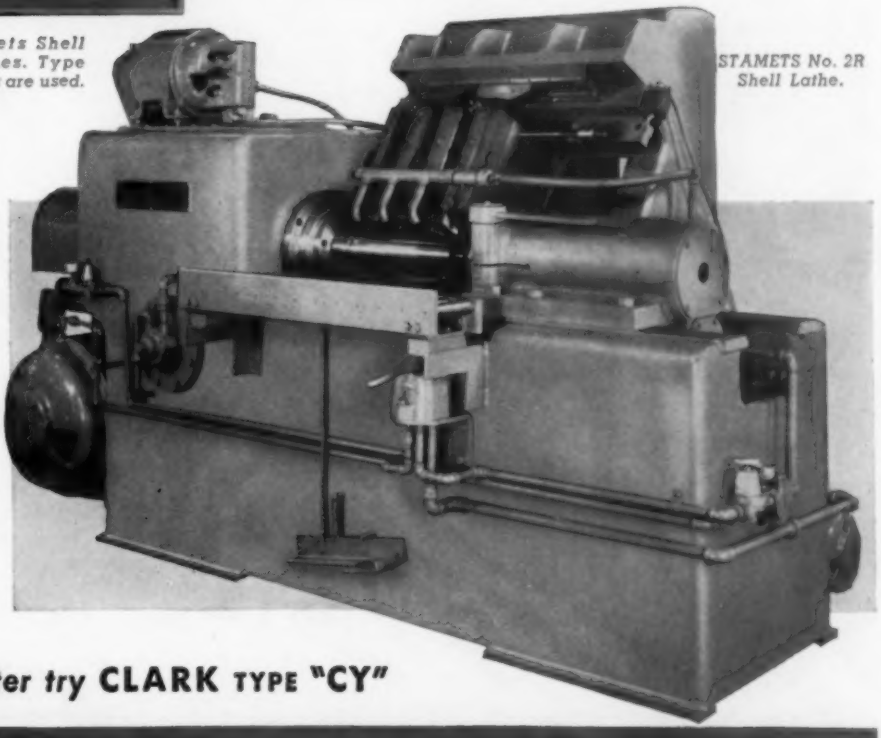
CLARK Control for Stamets Shell Roughing or Finishing Lathes. Type "CY" Contactors and Starters are used.

In several plants, Wm. K. Stamets No. 2R Shell Cut-Off machines, and Shell Lathes are producing 105 MM and 155 MM shells at a high rate.

Three types of machines, all with CLARK CONTROL, are used in each production line. A cut-off machine faces the solid end of the forging and cuts off the open end to the required length. The Roughing Lathe roughs out the shell, and the Finishing Lathe gives the shell its final contour and finish.

Depending on the size of the shells, and the optimum cutting speeds, the cut-off machines turn out 34 to 60 shells per hour.

While not completely automatic, the entire process is greatly simplified, loading and unloading, cutting off and turning of the shells is accomplished with a Foot Pedal, a "start" push button, and motion is stopped by a Limit Switch.



STAMETS No. 2R Shell Lathe.

Desirable cushioned stopping of the roughing spindle motor is accomplished by using current limiting resistance in the reverse plugging circuit. Smooth fast stopping, with no shock to the machine and no interference with production rate results.

Clark Type "CY" Starters and Relays controlling the Finishing Spindles provide completely satisfactory service.

Machine tool control problems are easily solved when CLARK TYPE "CY" equipment is used.

You'd better try **CLARK TYPE "CY"**

THE CLARK CONTROLLER CO.

ENGINEERED ELECTRICAL CONTROL • 1146 EAST 152ND STREET, CLEVELAND 10, OHIO

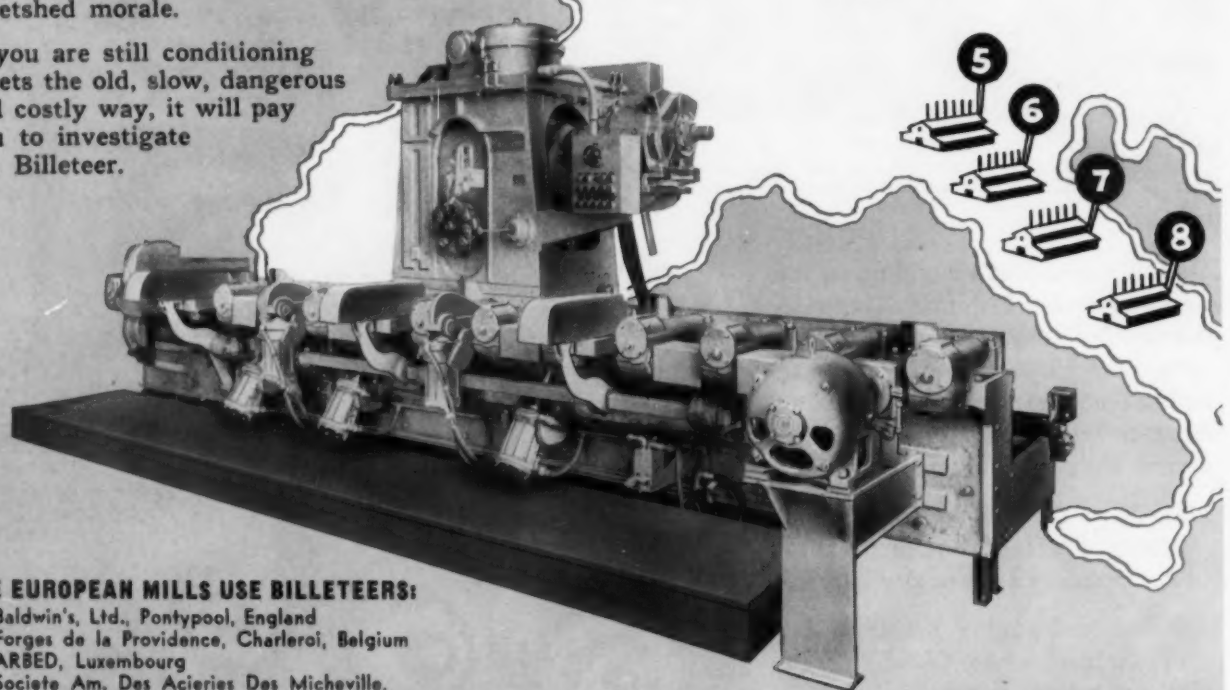
BILLETEER INVADES EUROPE!

Liberates Steel Producers from High Cost, Waste, Delays and Hazards of Manual Billet Conditioning

Since VE Day, more and more European steel producers are enjoying the advantages of Bonnot Billeteers in their billet conditioning operations.

- Conditioning costs are cut 50% and more. They get better work, ten times faster.
- Chips are 100% recoverable.
- Excessive melting is eliminated.
- Steady flow of clean billets, ready for rolling.
- Dependable scheduling is possible with reduced inventories.
- Safe, easy operation builds better billetshed morale.

If you are still conditioning billets the old, slow, dangerous and costly way, it will pay you to investigate the Billeteer.



THESE EUROPEAN MILLS USE BILLETEERS:

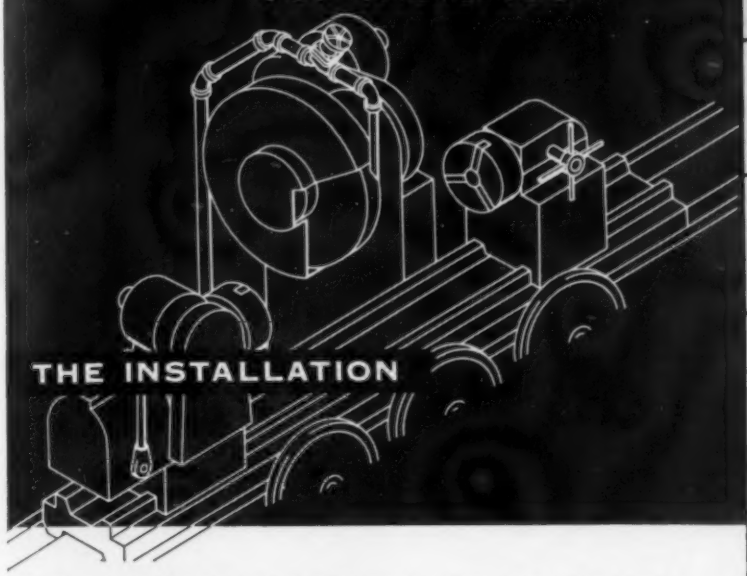
1—Baldwin's, Ltd., Pontypool, England
2—Forges de la Providence, Charleroi, Belgium
3—ARBED, Luxembourg
4—Societe Am. Des Acieries Des Micheville, Micheville, France
5—FIAT, Torino (Turin), Italy
6—Nazionale "Cogne," Aosta, Italy
7—Dalmine S. P. A., Bergamo, Italy
8—TERNI, Terni, Italy

Engineered For Improved Production

The Bonnot Co.
STEEL EQUIPMENT DIVISION
CANTON 2, OHIO

Also Manufacturers of — SAWING • PULVERIZING AND MIXING EQUIPMENT • BILLET INSPECTION TABLES
CRUSHING • DUST PUG MILLS • SINTER PLANT PUG MILLS

How this Valve Solved a Costly Problem ... on Abrasive Fluid, for instance



THE INSTALLATION

At Standard Crankshaft & Hydraulic Co., Inc., Charlotte, N. C., with Crane diaphragm valves on regrinding machines, controlling flow of grinding solution to the work.

VALVE SERVICE RATINGS

SUITABILITY:
Far better than expected

FEATURES:
Pliable Neoprene disc insert

MAINTENANCE COST:
Zero

SERVICE LIFE:
Now 8 times longer than other valves

OPERATING RESULTS:
Forced machine down time stopped

AVAILABILITY:
Crane catalog item—No. 1610

THE CASE HISTORY

About 3 weeks was the maximum service life of the conventional globe valves formerly on these machines. Their disc and seat were quickly cut out by the abrasive and steel dust that mixed with the re-circulated lubricant. Keeping up with replacements was costly in valves as well as extended machine down time.

Crane 1610 Diaphragm Valves were selected to help if not remedy the situation. They would last longer. Their pliable Neoprene disc insert would absorb the foreign particles that cause leakage and wire-drawing in ordinary valves. And when needed, a disc could be renewed in a few minutes.

But results were far better than expected. The Crane valves installed more than 6 months ago are still in service with no repairs; show no sign of trouble. Naturally, these valves have been put on all grinders.

THE VALVE

Neoprene disc insert seating is but one feature of Crane Packless Diaphragm Valves. Their sealed bonnet isolates working parts from line fluid. Independent disc and diaphragm design reduces diaphragm wear; permits closure on fluid even should diaphragm fail. These valves come in many body and trim materials for corrosive, abrasive, or common services. See your Crane Catalog or Crane Representative.

THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

the first helper's first helper at INLAND STEEL

ASKANIA OPEN HEARTH CONTROLS

In the new open hearth shop at Inland Steel Company's Indiana Harbor works, this panel houses one of four complete Askania control systems.

No control replaces the skill and judgment of an experienced open hearth operator. But an Askania installation adds to his skill by putting accurate and dependable control at the tips of his fingers. It is truly the first helper's first helper.

This is modern open hearth control—completely automatic but flexible. In the hands of your operators, it is a tool that helps them make more steel and better steel for less money. Furnace pressure is controlled to a hairsbreadth. Air flow and fuel flow are precisely proportioned to each other. Flow of atomizing steam to the burners is closely regulated to the operator's setting. Automatic reversal cuts fuel-off time to a few seconds, uses checker heat most effectively. A complete record of all that happens lets the operator duplicate his results in heat after heat.

Steel men rely on Askania Controls—common-sense controls that make their job easier and the results better. Askania equipment is simple and sturdy—designed and built to do the hardest jobs for the longest time.

Write for Bulletin 115, Askania Open Hearth Furnace Control.

ASKANIA REGULATOR COMPANY
246 E. Ontario Street, Chicago 11, Illinois
Subsidary of General Precision Equipment Corp.

Cities Service Cutting Oils Proved The Very Best By Micrometer Test!

CUTTER MEASURED WITH MICROMETER. As a final test, Automatic Pencil Sharpener measures each cutter with a micrometer. All tests proved that Cities Service cutting oil was absolutely tops for this really tough job.

STRICT SPECIFICATIONS REQUIRE FINEST CUTTING OIL. APSCO Sharpeners offer many more features than other brands. To produce their top quality product, Spengler-Loomis relies on top-quality lubrication products . . . Cities Service Products, famous throughout industry.

ONLY .005 INCHES BURR OR BUILD-UP ALLOWED IN FIFTY-HOUR OPERATION CUTTING GROOVE IN B1112 STEEL!

Says Mr. C. J. Kostrzewa, Plant Superintendent: "Cutting oil requirements in our Automatic Pencil Sharpener Division are tough. To find the right coolant, we called for, and tested, samples from various companies. Over a period of testing time, we used graphs, charts and tables, keeping a running record on all coolants. As a final test, we measured the cutter with a micrometer before and after milling. The cutting oil that came out tops was Cities Service.

"I'd also like to point out that the Cities Service Engineering staff co-operated fully by offering helpful advice and excellent service."

Why not discuss your lubrication problems with a Cities Service lubrication engineer? Write Cities Service Oil Company, Dept. G-11, Sixty Wall Tower, New York 5, New York—or contact your nearest Cities Service office.

CITIES SERVICE
QUALITY PETROLEUM PRODUCTS

Cleveland Cranes
FOR
STEEL MILL SERVICE
CLEVELAND
15 TON CRANE
CLEVELAND CRANES
MODERN ALL-WELDED STEEL MILL CRANES
5031 EAST 289th ST.
WICKLIFFE, OHIO

Crops *and* Shorts

ONE of the pioneer plants of the steel industry, the 83 year old Isabella furnaces of United States Steel Corp. at Etna, Pa., is coming to the end of a long and successful career. After two reprieves arising from World War II and the Korean action, the plant will be shut down early in August. The plant's production of ferromanganese will be moved to Duquesne Works where a new cleaning plant has been provided to keep the discharge peculiar to ferromanganese furnaces from the atmosphere.

Founded in 1870, Isabella furnaces carried on a spirited rivalry with Andrew Carnegie's Lucy furnaces across the Allegheny River, and through the early years, world records passed back and forth between the two plants, signified by a broom atop the winning stack. Isabella furnaces became part of United States Steel in 1901.

▲

LEST we get to feeling too prosperous, let's remember that we owe a federal debt of nearly $275,000,000,000, state and local debts of $25,000,000,000, corporate debts of $165,000,000,000 and individual debts of $84,000,000,000, for a total of some $550,000,000,000.

Well, it's been a grand binge!

▲

DOMINION Foundries & Steel, Ltd., at Hamilton, Ontario, is planning the installation of a solid bottom basic converter to be blown from the top with oxygen. The process is similar to that used at United Austrian Iron and Steel Works and described in the Iron and Steel Engineer for March, 1952.

▲

WHEN some husbands return from a round of golf at the club, their wives are convinced that the real hazard on the place wasn't water.

▲

A report from Columbia University shows that starting salaries for graduates of its School of Engineering averaged between $3000 and $3500 in 1950, between $3500 and $4000 in 1951, about $4000 in 1952 and about $4300 in 1953.

WE wonder if anyone is reminding the new graduates that a profession is something you study years to get into and then spend the rest of your life trying to earn enough to get out of.

▲

DISCUSSING his recent trip, E. T. Weir reports that Europeans feel their nations cannot continue to spend the large amounts now devoted to defense. They do not think there is imminent danger of war, but believe the time is right for a positive approach to peace. Mr. Weir believes the United States cannot "go it alone," but thinks we must treat our allies as partners and should do our part to negotiate with Russia.

▲

THE grass may look greener next door, but it's just as hard to cut.

▲

A process for the recovery of manganese from open hearth slag, developed in a project sponsored jointly by the American Iron and Steel Institute and the Bureau of Mines, could eventually supply up to one-half of the manganese requirements of the steel industry. The process, which entails a two-stage treatment, first in a blast furnace and then in a basic converter, does not present any technical difficulties but the economy of the process is yet to be determined.

▲

INHABITANTS of the United States are each eating two slices of bread per day less than they did 10 years ago, reducing the per capita flour consumption from 162 to 130 lb per year. The drop amounts to almost as much wheat as Kansas, the top wheat state, grew this year.

Well, it won't go to waist anyway.

▲

MAYBE it's possible in these atomic days, but we're skeptical about the politically-minded ion who heard there was going to be an electron, so it went to the poles and volted.

▲

THE 38 countries listed as steel producers in the "Free World" have an annual production capacity of about 218,300,000 tons of steel, over half of which is in the United States. The eight producers in the Soviet sphere have an annual capacity of 56,200,000 tons, of which 41,500,000 tons are in Russia.

▲

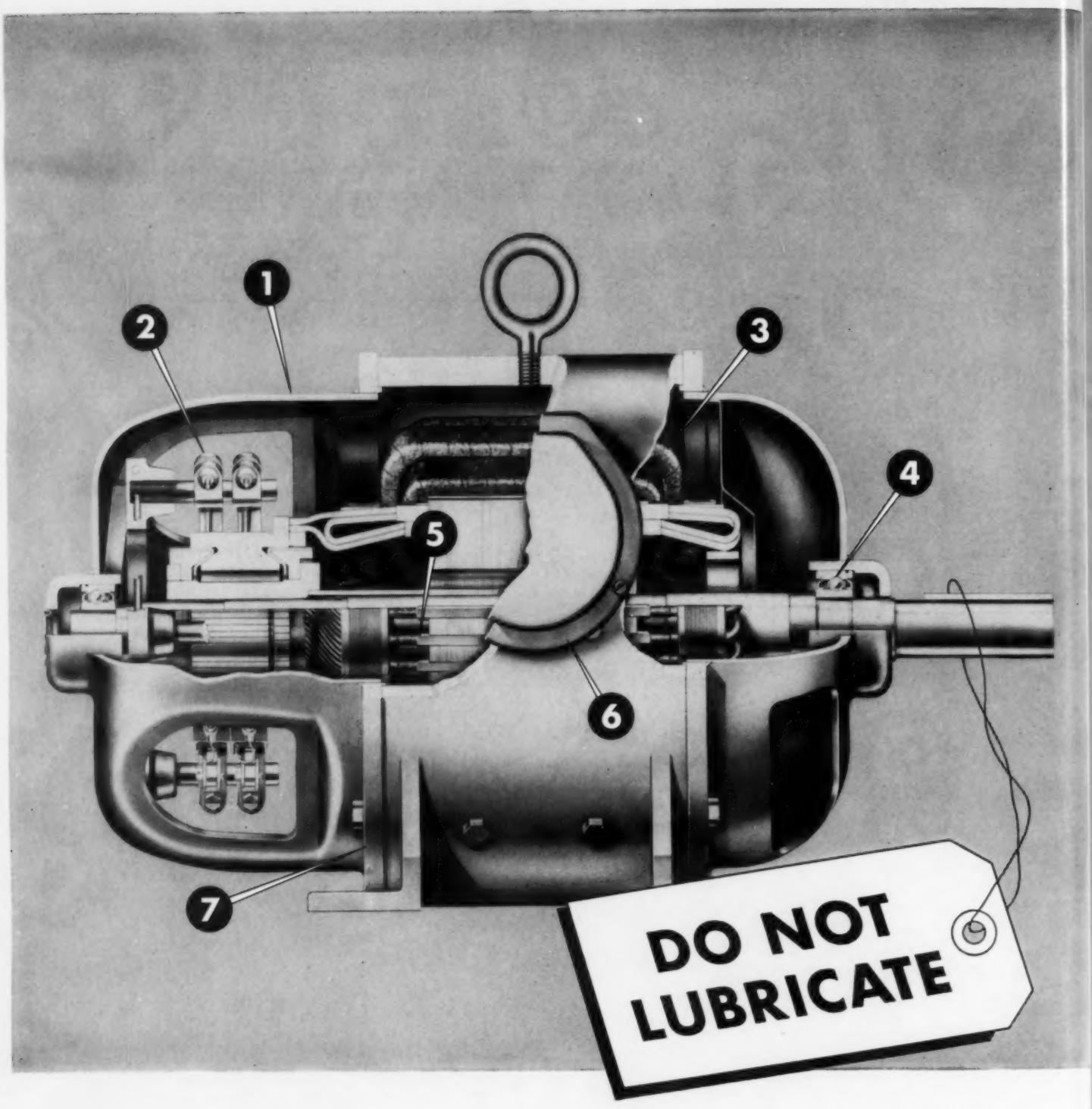
BUSINESS prognosticators complain about mixed trends confusing the outlook for future business. And how! A single page of a newspaper just informed us that the necktie business had taken a dive, but quinine water was enjoying a spectacular boom and vodka sales were running 60 per cent ahead of last year.

▲

TOTAL employment in the iron and steel industry reached a new high of 685,000 in April.

▲

NOWADAYS most folks seem to be seeking less to do, more time to do it in, and more pay for not getting it done.



1. ALL-STEEL BRACKETS
2. INDIVIDUALLY REMOVED CAST BRASS BRUSHHOLDERS
3. SHELL-WOUND FIELD COILS
4. DOUBLE-SEALED PRE-LUBRICATED BALL BEARINGS
5. HEAVY-DUTY PRESHAPED ARMATURE COILS
6. STEEL-GASKETED CONDUIT BOX
7. ROLLED-STEEL FRAME

SK DEPENDABILITY
Wrapped in Steel
in the Life-Line D-C MOTOR

Thirty-nine years at hard labor—in steel mills . . . in mines . . . in a thousand and one applications—have proved the dependability of the type SK d-c motor. Now, new dependability has been added—new motor stamina . . . new freedom from maintenance . . . new value for d-c motor users.

MAXIMUM STRENGTH AND RIGIDITY—Heavy steel end brackets and rolled-steel frame stand up to the shocking, jarring blows so often encountered in rugged d-c service.

SIMPLIFIED SERVICING—Readily accessible through spacious opening in front bracket, brushholders may be removed individually. Armature coils, wound from Tufvar wire and treated in Thermoset varnish assure long life . . . reduce trouble from shorts and grounds. Double-sealed pre-lubricated bearings (proved in over half a million motors) put an end to greasing problems.

INDIVIDUAL FIELD COIL UNITS—One coil may be replaced without expense of replacing all . . . or discarding pole piece. Just slip the new coil in place . . . save repair costs.

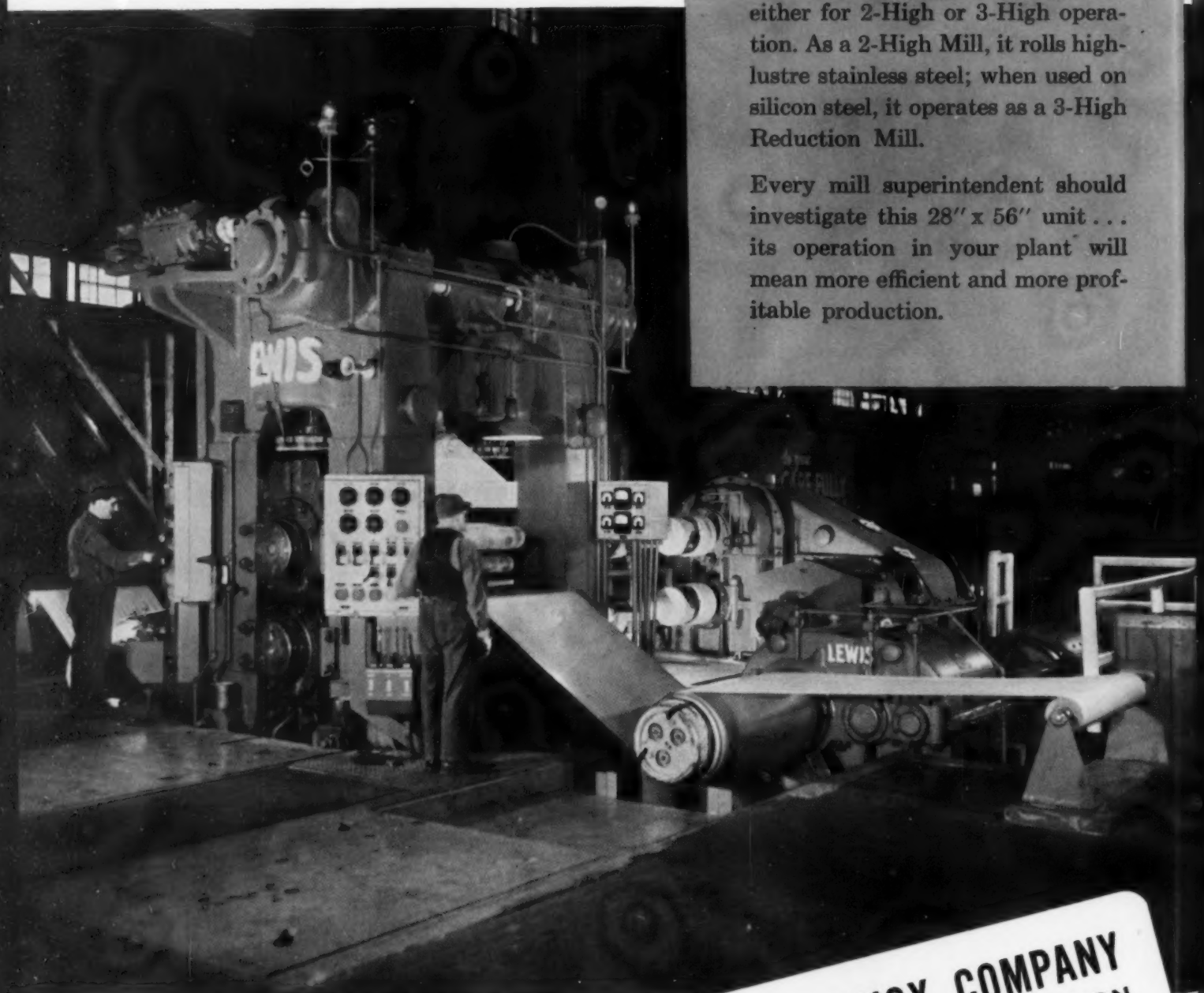
These are a few highlights of the new, all-steel Life-Line type SK d-c motor. Get the complete facts on series, shunt, or compound motors . . . frames 203-365 . . . in 1 to 30 hp ratings. Contact your local Westinghouse representative. Ask for a copy of "D-C Motor" Booklet B-4595, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21549-A

YOU CAN BE SURE... IF IT'S
Westinghouse

Easily Converted from 2-High to 3-High
NEW LEWIS MILL
Rolls Stainless Steel and Silicon

Installed for one of the nation's largest special steel producers, this new LEWIS Mill can be set up either for 2-High or 3-High operation. As a 2-High Mill, it rolls high-lustre stainless steel; when used on silicon steel, it operates as a 3-High Reduction Mill.

Every mill superintendent should investigate this 28" x 56" unit . . . its operation in your plant will mean more efficient and more profitable production.



Photograph courtesy Allegheny Ludlum Steel Corporation

BLAW-KNOX

BLAW-KNOX COMPANY
LEWIS MACHINERY DIVISION
PITTSBURGH 22
PENNSYLVANIA

T. J. ESS, *Editor*
I. E. MADSEN, *Associate Editor*
ALBERT W. ERICKSON, JR., *Production Manager*

Board of Directors

PRESIDENT
J. L. YOUNG
Vice President—Engineering
United States Steel Corp.
Pittsburgh, Pa.

FIRST VICE PRESIDENT, E. L. ANDERSON, *Superintendent Electrical Department,* Bethlehem Steel Co., Johnstown, Pa.

SECOND VICE PRESIDENT, JOHN H. VOHR, *General Superintendent,* Gary Steel Works, United States Steel Corp., Gary, Ind.

TREASURER, W. H. COLLISON, *Assistant General Superintendent,* Blast Furnace Division, Great Lakes Steel Corp., Ecorse, Mich.

SECRETARY, J. D. O'ROARK, *Assistant to Manager, Service and Maintenance,* Weirton Steel Co., Weirton, W. Va.

PAST PRESIDENTS: A. S. GLOSSBRENNER, *Vice President Operations,* Youngstown Sheet and Tube Co., Youngstown, Ohio.

I. N. TULL, *Electrical Superintendent,* Republic Steel Corp., Cleveland, Ohio.

HONORARY DIRECTORS: JAMES FARRINGTON, *Special Assistant to Chief Plant Engineer,* Wheeling Steel Corp., Steubenville, Ohio.

C. L. McGRANAHAN, *Technical Assistant to Works Manager,* SOLLAC, Seremange (Moselle), France.

L. F. COFFIN, *Assistant General Manager,* Bethlehem Steel Co., Sparrows Point, Md.

DIRECTOR-AT-LARGE: L.LARSON, *Chief Engineer,* Republic Steel Corp., Cleveland, Ohio.

DIRECTORS: C. G. MARSHALL, *Superintendent of Construction, Engineering — Raw Materials Division,* Tennessee Coal and Iron Division, United States Steel Corp., Fairfield, Ala.

A. M. CAMERON, *Superintendent Rolling Mills,* Atlas Steels Limited, Welland, Canada.

F. A. JOHANTGES, *Electrical Engineer,* International Harvester Co., Wisconsin Steel Works, Chicago, Ill.

W. W. BENTZ, *Superintendent Maintenance,* McDonald and Upper Works, United States Steel Corp., McDonald, Ohio.

ROBERT SERGESON, *Chief Metallurgical Engineer,* Rotary Electric Steel Co., Detroit, Mich.

J. S. MORRIS, *Supervisor of Construction,* Lukens Steel Co., Coatesville, Pa.

EMIL KERN, *Vice President in Charge of Engineering,* Allegheny Ludlum Steel Corp., Brackenridge, Pa.

L. V. BLACK, *Superintendent Electric Department,* Bethlehem Steel Co., Bethlehem, Pa.

E. T. W. BAILEY, *Chief Combustion Engineer,* The Steel Co. of Canada Limited, Hamilton, Canada.

T. M. FAIRCHILD, *Assistant to General Manager,* Franklin Mills, Bethlehem Steel Co., Johnstown, Pa.

D. W. LLOYD, *General Superintendent,* Indiana Harbor Works, Youngstown Sheet and Tube Co., Indiana Harbor, Indiana.

F. E. ROBINSON, *Assistant Division Engineer,* American Steel and Wire Division, United States Steel Corp., Cleveland, Ohio.

R. A. KRAUS, *Assistant Maintenance Superintendent,* Republic Steel Corp., Chicago, Ill.

Managing Director
T. J. ESS
Empire Building
Pittsburgh, Pa.

Iron AND Steel ENGINEER

JULY, 1953 VOLUME XXX NUMBER VII

In This Issue

Patent Reviews — By Melvin Nord, Patent Attorney, Detroit, Mich..... 25

Rehabilitating a Blast Furnace and Associated Equipment — By W. C. Daniels, Superintendent, Mechanical Department, Bethlehem Steel Co., Lackawanna, N. Y..... 57

The Magnetic Amplifier in Control Circuits — By R. W. Moore, Manager Development Engineering, Control Engineering Dept., Westinghouse Electric Corp., Buffalo, N. Y..... 67

Wide Range Metering of Oxygen in Steel Plants — By Marshall S. Gare, Manager, Ring Balance Division, Hagan Corp., Pittsburgh, Pa..... 74

High Speed Mills and Their Application to Ferrous and Non-Ferrous Rolling — By George Perrault, Jr., E. W. Bliss Co., Salem, Ohio..... 83

Tentative Program, AISE 1953 Annual Convention..... 92

The Pumping, Transmission and Burning of Tar and Pitch — By Warren A. Pond, Manager of Industrial Viscous Fluid Dept., Fluid Systems, Inc., New Haven, Conn..... 94

AISE, The Engineering Society of the Iron and Steel Industry..... 100

Applications for AISE Membership..... 102

Rolling Mill Yield — By Leo R. Silliman, Superintendent of Conservation, Republic Steel Corp., Buffalo, N. Y..... 103

Hints for Sealing Storage Battery Cells..... 112

New Safety Hook Block Will Reduce Crane Accidents..... 116

Kaiser Steel Dedicates Third Fontana Furnace..... 118

Date-Line Diary..... 127

Industry News..... 133

Personnel News..... 163

Equipment News..... 181

Index to Advertisers..... 203

Published Monthly by
ASSOCIATION OF IRON AND STEEL ENGINEERS
1010 EMPIRE BUILDING
PITTSBURGH 22, PENNSYLVANIA

Statements and opinions given in articles and papers appearing in "Iron and Steel Engineer" are the expressions of contributors, for which the Association of Iron and Steel Engineers assumes no responsibility.

Copyright, 1953, The Association of Iron and Steel Engineers.

Indexed by Engineering Index and by Industrial Arts Index.

Single Copy Foreign Prepaid $2.00 Single Copy $1.50
Subscription price in U. S. and Canada (U. S. funds)..... $ 7.50 per year
Subscription price in foreign countries..... $10.00 per year

PLASTIC BINDING U. S. PATENT NO. 1970285 LICENCE NO. 120

World's Largest Builders of World's Largest Cranes

Alliance...

FIRST IN SIZE! FIRST IN CRANE DESIGN!

LOOK AT THE FEATURES OF THIS NEW CRANE!

- **Working parts easily accessible for quick maintenance.**
- **Adequate end bracing and large gusset plates keep crane square and girders plumb.**
- **Liberal safety factors . . . girders, ropes, bearings, gearing, motor sizes.**
- **Sealed lubrication on all roller bearings.**
- **Enclosed controls keep out mill dirt and, as located on foot walk, provide maximum accessibility.**
- **Operation easily and accurately controlled. Operator's cab located at center of bridge gives best visibility.**
- **One-piece welded trolley frame.**
- **All-steel construction including cast steel drums.**

For over half a century leading mill designers and builders for heavy industry have turned to The Alliance Machine Company for dependable heavy-duty cranes. Alliance has constantly pioneered mechanical features which are accepted today as conventional. Alliance can develop equipment best suited to your company's particular heavy material handling needs. Write for full information.

THE ALLIANCE MACHINE COMPANY

MAIN OFFICE • ALLIANCE, OHIO • PITTSBURGH OFFICE • OLIVER BUILDING, PITTSBURGH, PENNSYLVANIA

Alliance Standard Steel Mill Crane in the Cold Strip Reduction Department of the Fairless Works, U. S. Steel Corporation. This standard overhead crane has a 100-ft. span, with a 90-ton main hoist and 30-ton auxiliary hoist.

REHABILITATING A BLAST FURNACE AND ASSOCIATED EQUIPMENT

By W. C. DANIELS
Superintendent, Mechanical Department
Bethlehem Steel Co.
Lackawanna, N. Y.

. . . . productive capacity of steel industry has also been effectively increased through the ingenuity of the maintenance man, which has succeeded in reducing down-time of equipment out for rehabilitation . . . .

▲THE blast furnace operation is probably the least predictable of any of the operations in a modern steel plant. Furnace men invariably refer to their charge as "she" and insist that this is so only because of the tempermental way in which she absorbs her charges and gives forth her molten product which forms the basis of subsequent steel making operations. We might refer to her as a sort of Amazonian lady Paul Bunyan who performs an enormous and very necessary step in making the American way of life what it is today.

All of the above comments apply to the normal operation of the blast furnace. When a furnace has burned herself out and has stressed and strained many of her appendages almost to the breaking point, she must be completely rehabilitated, even to a new coat of paint before resuming her gigantic task.

In the usual integrated steel plant, capacities of the various processes are such that each one is capable of producing the material necessary for the following process. Obviously, when a large unit such as a blast furnace is out of production, subsequent units must suffer either loss of production, cost of production, or both. A high hot metal charge in an open hearth furnace helps produce steel at a maximum rate. With steel scrap prices what they are today, molten pig iron is probably the cheaper of these two materials used in the production of steel.

In the rebuilding of a blast furnace unit, we feel that two factors must be born in mind. The first is the excess cost involved in the steelmaking units because of loss of iron production. The second, the excess cost of rebuilding a blast furnace in a minimum of downtime. It is well known that to push a job around the clock seven days a week, requires a large amount of premium time for labor. Economically, this should balance or preferably be less than the added cost of steelmaking because of the lower iron production.

In the Lackawanna plant, blast furnace rebuilding is done under the plant central maintenance supervision. Planning of the job is done by this same supervision with the help of the engineering and blast furnace operating departments.

Weekly meetings of these departments are held during the preliminary work period and during the job. These meetings deal with progress checks and problems that arise on the overall job. Daily on-the-job meetings are held among the supervision of the various crafts involved.

Furnishing the necessary craftsmen and labor for a job of this nature requires very careful study. Plant maintenance forces are used to a maximum degree commensurate with keeping the rest of the plant operating while the rebuild is going on. Where we have been unable to furnish enough help from our own forces, we have had to bring in outsiders for some predesignated part of the job.

Proper equipment and tools are a very necessary part of any job of this nature. We have found a decided decrease in labor hours and a speed up of the job since equipping ourselves with as many labor saving devices as possible. Among these, we might mention extra heavy duty hoisting engines and other rigging

equipment, along with smaller power tools such as chugger hoists, power wrenches, concrete drills. Other equipment would include mobile cranes, bulldozers, belt conveyors, roller conveyors, and many more.

Planned material handling is essential. Total tonnages of waste removed and material installed are enormous. To handle this in the limited space available, presents many problems, always different, depending on the furnace involved and the work to be done.

Proper simulation of a furnace rebuild is a must if labor is to be used efficiently and furnace downtime held to a minimum. To us, this means working all parts of the job a maximum amount of the time without interfering with others doing another phase of the job in the same way. This is easy to say, not so easy to do. Each part of the job must be planned to fit into its own little niche at the right time to best facilitate the doing of all the other jobs which must be planned and fitted in the same way.

We must not forget the safety angle in planning these major jobs. All protective safety devices available are used whenever they are needed. Safety supervisors are on duty throughout the full working period. When planning the job, safety to the many workmen is of prime importance.

One of the best examples of the principles mentioned above was the 1951 rebuild of our F blast furnace at Lackawanna. The rebuilding of this particular furnace involved considerably more work than what is generally normal, replacement of the brick lining. There were several major furnace auxiliaries that had to be rebuilt along with the relining and which will be discussed in detail later. This was an accelerated job and was completed in record time for our plant. Total time from the last cast of the furnace until hot blast was put on to dry out the brick work was nineteen days, nineteen hours and fifty-five minutes. The total time consumed from furnace down to wind-on was 29 days, 23 hours, and 22 minutes, whereas time to first cast was 31 days, 11 hours. This furnace was given 8 days dry out time and required 14 hours to fill.

"F" furnace is a medium size furnace according to present day standards. Hearth diameter is 25 feet, mantle diameter 28 feet, height from the lip ring to the top of the hearth is 94 ft 11½ in. The stack has a volume of 25,960 cu ft, the bosh 6902 cu ft, the hearth 5154 cu ft. A straight ceramic lining was used in both the old and the new.

The overall job might be divided into four parts. All work possible was done on operating units before the furnace went out of blast. Prefabricated sections of new parts, such as ore bins and dust catchers were made off the site during this same period. After the foregoing was complete and the furnace out of blast, the major part of the work had to be done. Some parts of the work could best be completed after the furnace was back in blast and was scheduled at this time. These four points and their importance, will be illustrated further on in this paper.

The furnace proper was to have all new bleeder valves, new bleeder valve winches, and the top deck was to be reinforced. Bell mechanisms were inspected and overhauled. A rebuilt top, a new small bell, a new hopper and a new large bell and rod were installed. On the stack, there were 10 additional rows of plates installed, 24 plates to a row. This necessitated, of course, cutting new holes in the shell and welding reinforced plates around the hole. Work platforms had to be installed to service these additional plates and the cast house roof altered to accommodate them.

The tuyere breast and the bosh bands remained the same. Hearth jacket was not changed, but all hearth cooling plates were renewed.

A new mud gun, with foundation, was installed. A new dam, new iron runners, with greater slope, were also installed. All new cinder runners on the west side of the furnace were installed and cinder runner platform was changed.

The determining factor in the rebuild of F furnace was the amount of work necessary to its auxiliaries. Blast furnace F has 11 double ore bins, 25 feet each in length totalling 275 feet. These bins had deteriorated to such an extent that they had to be removed. These bins had been put in originally as an individual unit to go with the furnace. There is an adjacent furnace, whose scale car tracks were on a different center line by several feet. This meant that scale cars could not travel from one furnace to another, and required a duplication of spares. Inasmuch as the bin structure was to be changed entirely, it was decided to relocate these new bins on the same center as the adjacent furnace bins, so that the scale cars could run common to both.

In connection with changing of the ore bins, it was felt advisable to install new and larger capacity coke bins which are adjacent to the ore bins. This meant of course, all new foundation work, as well as steel work, relocation of the grizzlys and conveyors; also, an extensive alteration to the skip pit.

The skip incline was structurally weak, and was to be changed. The new skip incline was made much heavier in section and, instead of the old type straight incline stairway, a cross flight stairway was installed. Due to this increased weight, it was found necessary to drive piling and install new foundations.

The present dust catcher was inadequately proportioned to the size of the furnace; a new and larger one was installed. This required all new foundations and

Figure 1 — A temporary stairway to the top of the furnace stoves was built prior to shutdown.

Figure 2 — Initial planning showed that more time would be required to rebuild the ore bins than to rebuild the furnace.

steel work; also, extensive alteration to down comers and other gas piping. This new dust catcher is 30 ft 11 in. inside diam by 40 ft high from base to cone. It is refractory lined.

In addition, there was the usual track work; paving and replacing of cast house floor; brick work, patching in offtakes, bustle pipe and hot blast mains. New hot blast valves were installed on all four stoves; new stack valves and foundations for same. Three stoves were repaired while the furnace was out of operation. One stove was left for rebuilding after the blowing in period. New controls were installed for stock line mechanism, for automatic bleeders, etc., and a new control house and pyrometer house were built on the cast house floor. In addition, a completely automatic lubrication system was installed on furnace top mechanism, gas seal, skip hoist, grizzlys and ore bin doors.

On the side of the furnace adjacent to the skip incline, coke bins, ore bins and dust catcher, there was only one usable track and no room to install additional track or to work any tractor or truck cranes. It was planned to have two cranes on this track, one working from the north and one from the south; one to work on the skip incline and the other to work on the coke bins. This left no crane service from that side to work on the dust catcher. It was therefore decided that the only practical method of tearing down and rebuilding the dust catcher was by a Chicago boom. This was mounted on No. 1 stove to service the dust catcher well in advance of shutdown. Since this furnace has no elevator, and since removing the skip incline would necessitate the removal of the stairway, it was also felt necessary to build an auxiliary stairway to the top of the blast furnace, before shutdown.

Figure 1 shows a good view of the Chicago boom mounted on No. 1 stove, and the temporary stairway to the top of the furnace stoves staggered between No. 2 and No. 3 stoves.

The bottleneck of the entire job was definitely the problem of the new ore bins. There were simply not enough hours in the shutdown time allotted to change the steel. In addition, the main ore larry line that supplied the other furnaces ran over the top of these bins so that no section could be out of service for a period longer than a six hour interval. This obviously pointed toward prefabrication and installation in large sections rather than fabrication on the site.

It was decided to break this 275-foot section of bins into five sections; to prefabricate those on the leveled ore pile; and to roll them into position during relatively short shutdown periods.

Being the spring of the year, when ore supplies were low, the furnace operators agreed to the loss of a portion of their ore storage yard, which was promptly cleared for fabricating purposes.

They also agreed to run for a short period of time without the south two-fifths of their bin capacity prior to shutdown. This meant that the only sections that had to be changed during shutdown were the center sections that tied in with the coke bins and one of the north sections, with the last sections to follow at any time in the future.

Figure 2 shows an overall picture of these bins with F furnace in the background. Some of the main carrying girders of the larry car track have already been un-

Figure 3 — Fabrication on the bins was started on the site long before the blast furnace was shut down.

Figure 4 — No. 4 and No. 5 bins are shown here almost completely fabricated.

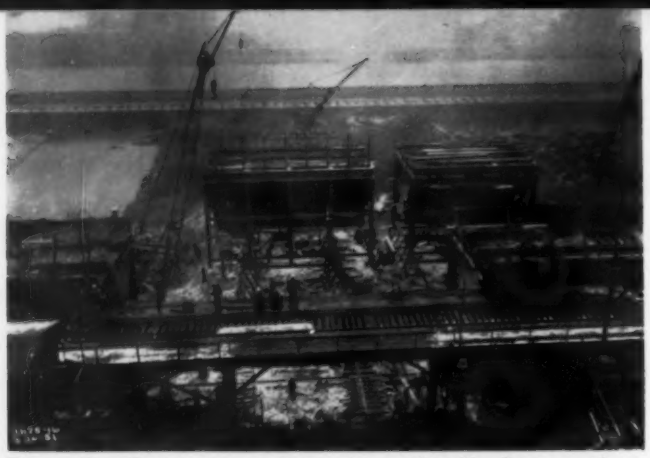


Figure 5 — Rails were positioned to roll in No. 5 bin section.

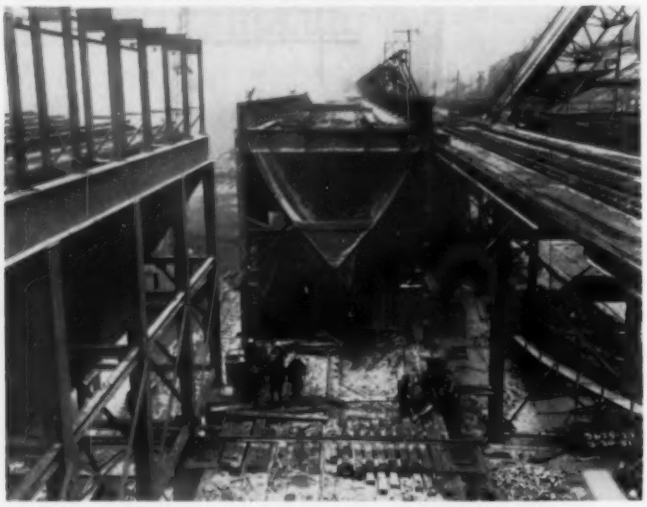
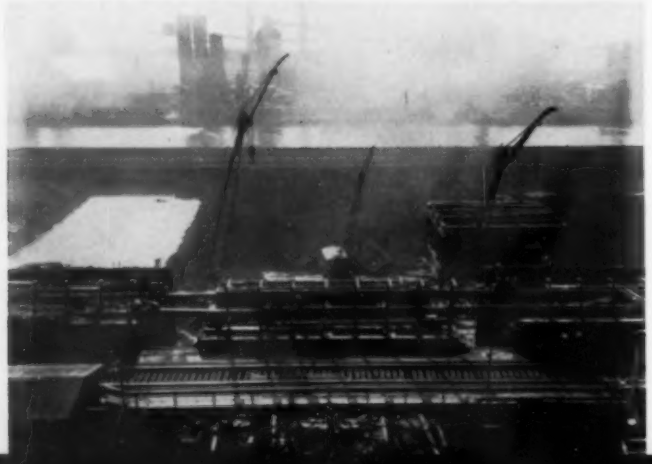


Figure 6 — The bin is here being rolled into position.

Figure 7 — Rollers were removed and the column gusset plates installed.

Figure 8 — Job is now ready for traffic to run over the new section.



loaded on the ground. Two mobile trucks are pouring the foundations for the bins, and the start of the prefabrication on this project has begun.

Figure 3 shows the first section of the ore bins being prefabricated on the site. It also shows the exposed old structural work that had to be replaced with the new.

The first actual move on these ore bins was done on March 20, 1951.

Figure 4 shows the view from the ore yard, showing the two tractor cranes in position for stripping the old bins. It also shows the complete fabricated section for No. 5 bin which is complete with contact rail supports and carrying rails for the larry car. Notice the almost completed No. 4 section of the ore bin, ready for a future move.

Figure 5 shows a plan view of this operation an hour later with the rails positioned for rolling in the No. 5 bin section.

Figure 6 shows the section of bin just rolling into position.

Figure 7 shows the method of removing the rollers and putting on the column gusset plates.

Figure 8 shows the completed job a few minutes before traffic was allowed to resume over the installed section.

This being the first section to be so handled, it naturally required a longer time than the remainder. This No. 5 section was moved in with a loss of traffic of 7½ hours. With repetition, this time decreased until the outage on the last move was 5 hours and 20 minutes.

To shorten the outage time of the furnace, it was necessary to do all foundation work possible before shutdown. To this end, the new foundations for the skip incline and coke bins were designed so the piling could be driven during operation. A concrete bridge was installed to span from the new piling to the present piling. Foundations were then completely installed.

Figure 9 shows a view of these concrete spanning beams and, in the background, the foundation form for the new skip pit. As mentioned before, this was done under operation.

The column frame work of the new coke bins, being larger, was built surrounding the present columns, so that after shutdown all that was necessary to complete them was the horizontal structure on top of the bin.

The blast furnace department agreed to do without the west sinter platform for 8 hours per day. The old platform was disassembled and the new one installed before the furnace was blown out.

Figure 10 shows the completion of this job.

Foundations for the dust catcher and the new stove stack valves were also installed before shutdown.

The access platforms and walkways to service the new stack cooler plates were entirely installed before shutdown. This was done by keeping a careful check of gas analysis, working with the wind, and with gas masks when necessary.

Figure 11 shows a view of a portion of these walkways, visible above the cast roof. Note top hoist boom already rigged at the upper left.

Figure 12 shows this job completed, including the weather proofing shell.

One of the most outstanding time saving preliminary jobs was done for the first time in our plant on F blast

Figure 9 — Maximum amount of foundation work was done before shutdown.

furnace. The top was completely rigged before the furnace was shut down. It was felt that inasmuch as our mechanics were used to working in gaseous atmospheres on various jobs using masks, it was certainly worth the effort to put on gas masks and rig the top of the furnace. This was done, with one exception, which was the top line to handle the large bell rod. It was installed after the furnace was down.

The furnace was rigged entirely from the east side so as not to interfere with crane operations from the west side, servicing the ore and coke bins, skip incline, etc. It is interesting to note that this preliminary work did not slow operations, as the furnace broke its all time record the month before shutdown.

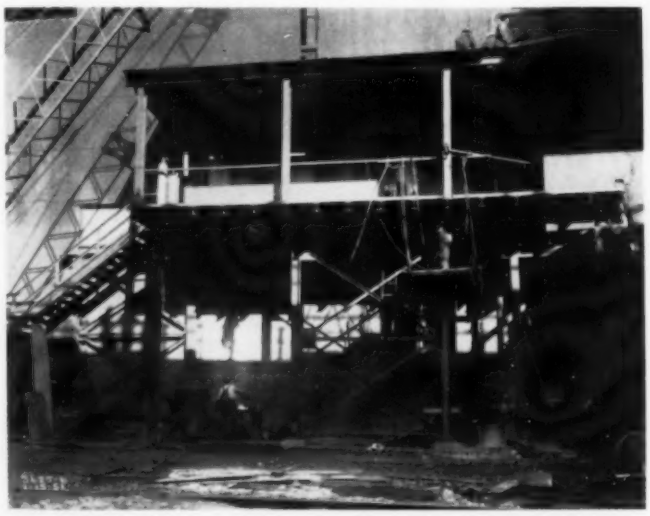


Figure 10 — Completed sinter platform is shown here.

To facilitate the erection of the new dust catcher, it was decided to prefabricate in as large sections as could be handled by crane. This was done in the field north of the furnace.

Figure 13 shows portions of the inner cone already assembled, and work progressing on the outer shell. These sections were fitted one to the other to insure fast erection, and were then partially disassembled and taken to the furnace as individual rings. After preliminary work mentioned above was complete, the furnace was shut down.

Figure 11 — Access platforms and walkways for the new stack cooler plates were installed before shutdown.

A breakdown list of all the starting and completion times of the different items on the rebuild would be too detailed for this paper, but a few of the times will be given to show the overall progress of the job.

The last cast was completed at 3 p.m. April 1, 1951 and the salamander run started at 3:20 p.m. It finished at 10 p.m. of the same day. Quenching of the furnace commenced at 10:15 p.m., April 1, and continued until 7:30 a.m. of April 2nd. The removal of the furnace top started at 8 p.m. April 2nd and was completed at 10 p.m. April 3rd. The tearout scaffold was installed on the night turn and was completed by 6:30 a.m., April 4th. The brick contractor started to tear out the old

Figure 12 — Illustration shows completed walkways and weather proofing shell above cast house roof.

Figure 13 — Inner cone has already been assembled and work is progressing on the outer shell.

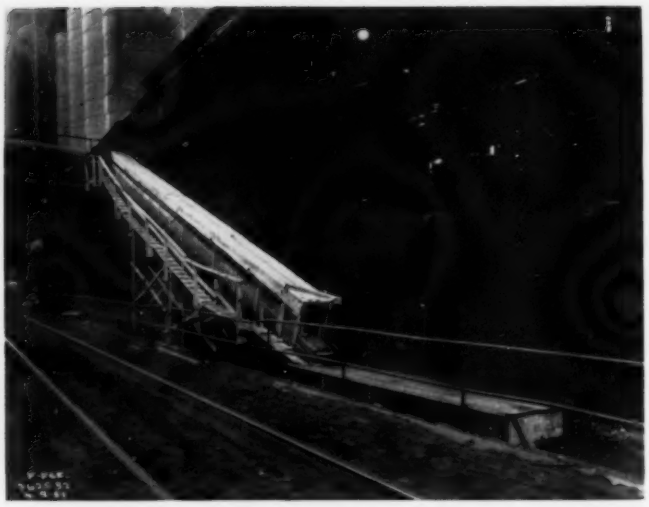


Figure 15 — Conveyor was used to haul the brick from the cars to the hearth.

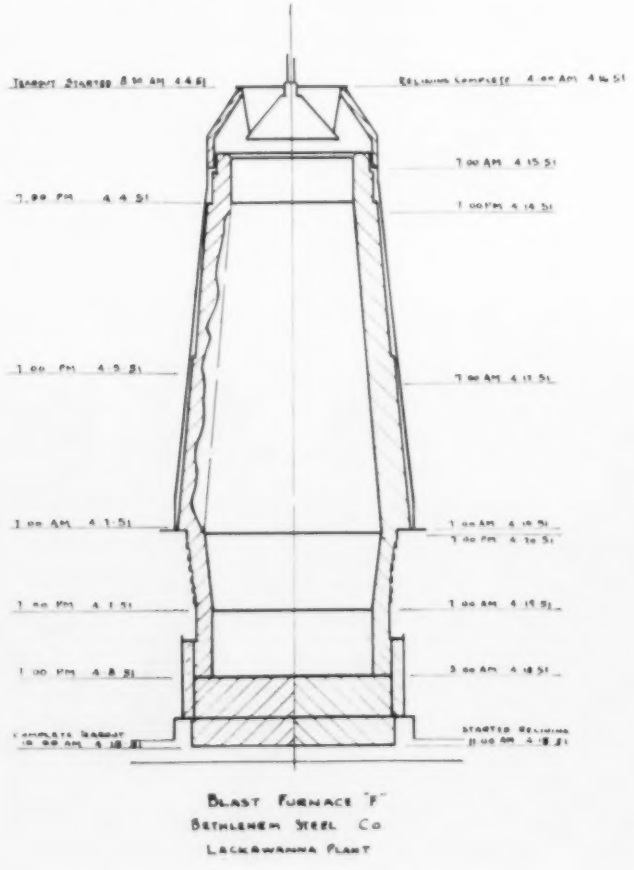
lining at 8:30 a.m., April 4th; it was torn out to the mantle by 7 p.m. April 7th.

Figure 14 shows the outline of the remaining lining as it was when removed.

Tearout was completed to top of tuyere breast at 7 p.m. April 7th. Tearout was completed to top of hearth jacket at 7 a.m. April 8th. The five courses of 18-in. bottom block were removed by 7 a.m. April 9th.

Having ascertained at this point that there was no iron button in the furnace, it was decided to start bricking the stack from the mantle up. This operation was started at 7 a.m. April 10th and was completed at 4 a.m. April 16th.

Figure 14 — Schematic sketch shows progress of tearout on left and relining on right.



While there was no iron button, the sub bottom of the furnace had been completely vitrified and had some iron stringers in it. Including this additional work, the bottom tearout was completed about 10 a.m. April 15. This was just six hours after the brick work in the stack was completed to the lip ring of the furnace. The brickwork in the hearth started at 11 a.m. April 15th and was completed at the mantle at 2:26 a.m. April 21st.

It had been planned to finish the brick work in the stack two to three days ahead of the hearth brick work to allow for installation of the top while still bricking the hearth. The unexpected work in the sub bottom actually delayed the furnace down time by 48 hours.

There were a few items of interest in the actual bricking of the furnace:

Figure 15 shows the conveyor used to transmit the brick from cars to the hearth. A similar conveyor conveyed the brick up and across the cast house floor, and delivered it to the platform in front of the furnace as shown on Figure 16. This shows the top of the steel platform that was built to the height of the top of the bustle pipe. To this, brick was delivered and stocked by

Figure 16 — The extensive use of conveyors is illustrated in this view.

conveyors from the cars. You will note that five lines of brick are being fed into the furnace, where it was taken up the stack to the bricking platform by hoists. At the speed the bricklayers were traveling, there was no time to hoist slurry. It was mixed and forced to the furnace top by air pressure. An arrangement of the mixing tanks and the pressure tanks is shown on Figure 17.

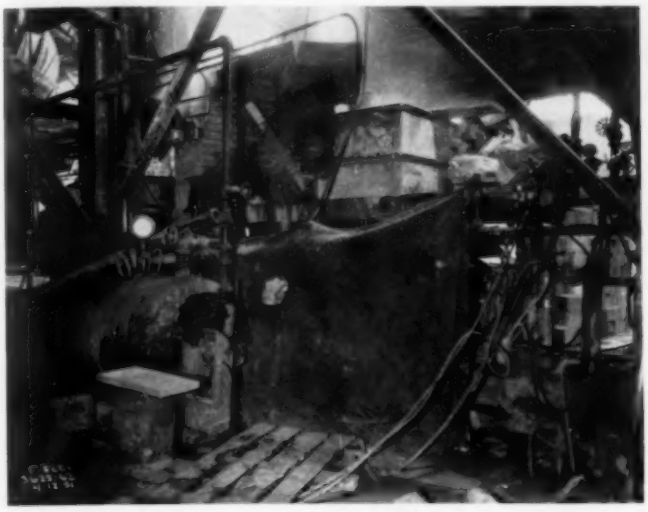


Figure 17 — Slurry was mixed and forced by pressure to the furnace top.

A few other illustrations will show the different jobs that were necessary to be worked on at one time. They also serve as photographic evidence of progress.

Figure 18 shows the middle section of the ore bins, with the plate sides of the west side of the coke bins already installed on it, being rolled into position. It also shows the coke bin structure complete, with the exception of the bin lining.

In the foreground can be seen a crane boom servicing the plate rings for the installation of the dust catcher.

To show the rate of progress on the furnace, the following pictures were all taken on April 16th:

Figure 19 shows the installation of the hearth jacket patch that was removed to permit access of bulldozer for lining and bottom removal.

Figure 18 — View shows middle section of ore bins and coke bin structure.

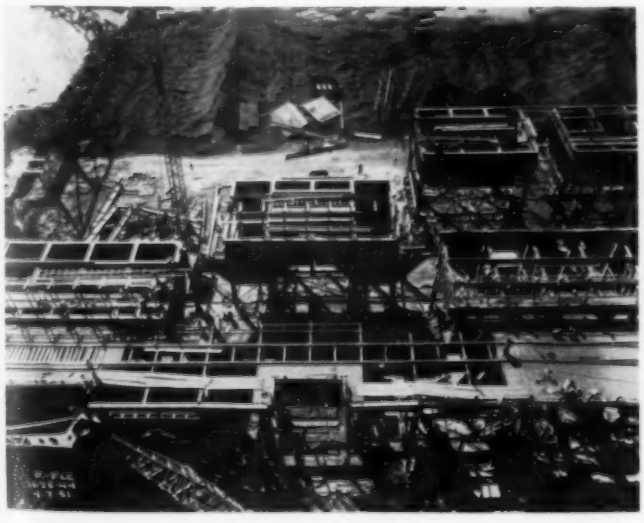


Figure 19 — A section of the hearth jacket was removed to permit use of a bulldozer for lining and bottom removal.

Figure 20 shows the progress on the dust catcher. Crane boom in background is erecting skip incline. Note method of supporting the cut off downcomers.

Figure 21 shows one of the key moves of the furnace rebuild. It shows the lowering of the large bell into position on beams, on top of the furnace lining. This bell was not actually installed with anyone working in the bottom of the furnace. The riggers worked during the time the bricklayers were out of the furnace eating their lunch, lowering the bell from the furnace top on to the pictured beams.

Figure 20 — Erection of dustcatcher is under way at this time.

Figure 21 — Large bell is lowered into position on beams on top of furnace lining.

Figure 22 — Overall view shows furnace on day when it was blown in.

After the bricking of the furnace was completely finished at 2:26 a. m. April 21st, the penstocks and tuyeres were put in position and hot blast was put in the furnace on April 21st at 10:55 a.m. This gave an elapsed time from cast to dry out of 19 days, 19 hours, 55 minutes. On April 29, at 11:30 a.m., the hot blast was turned off the furnace and cold blast was admitted to cool the furnace so the carpenters could get in and install the shock scaffold. The penstocks were pulled the following morning on April 30, at 6:30 a.m. and the

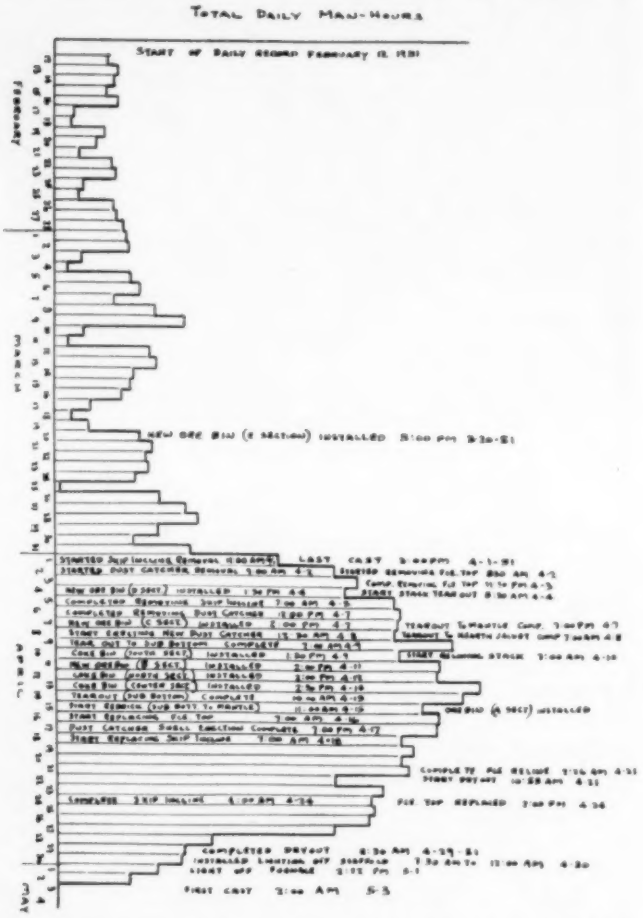


Figure 23 — Chart shows labor required for the rebuild job.

carpenters erected the shock scaffold from 7:30 in the morning until 12 noon. The furnace was filled overnight and was blown in at 1:00 a.m. May 1st.

Figure 22 shows a panoramic view of the furnace and ore bins as of the date of blowing in.

Figure 23 shows a graphical representation of the total man hours per day starting from the date of the

TABLE I

"F" Furnace — Lackawanna Plant

Tabulation of Elapsed Furnace Rebuild Time

Operation	Date	Time	Elapsed Time
Final cast	4- 1-51	3:00 pm	.....
Brick lining complete	4-21-51	2:26 am	19 days 11 hrs. 26 min.
Hot blast on furnace	4-21-51	10:55 am	19 days 19 hrs. 55 min.
Cold blast on	4-29-51	11:30 am	27 days 20 hrs. 30 min.
Scaffold installed	4-30-51	12:00 noon	28 days 21 hrs. — min.
Furnace filled and blown in	5- 1-51	2:22 pm	29 days 23 hrs. 22 min.
First cast (quality)	5- 3-51	2:00 am	31 days 11 hrs. — min.

first preparation and continuing through to the job completion. From it can be gathered the rise and fall of the tempo of the job.

Table I gives a summary of the various important "times" in this rebuild as mentioned throughout this paper.

From what has been said above, it can well be gathered that the rehabilitation of a plant furnace is a major maintenance operation. Its completion can well be celebrated by maintenance and operating personnel alike.

DISCUSSION

PRESENTED BY

H. O. WICKS, JR., Assistant Plant Engineer, The Hanna Furnace Corp., Buffalo, N. Y.

W. C. DANIELS, Superintendent, Mechanical Dept., Bethlehem Steel Co., Lackawanna, N. Y.

STANLEY J. SAREK, Superintendent of Blast Furnaces, The Hanna Furnace Corp., Buffalo, N. Y.

A. M. CAMERON, Superintendent of Rolling Mills, Atlas Steels Limited, Welland, Ontario, Canada.

H. O. Wicks: We at Hanna Furnace are always interested in anything pertaining to the thousand and one details of a furnace reline, since our major output is merchant pig iron made by four blast furnaces, which also have to be relined periodically. The installation of the new ore bins was of particular interest, as was the method of prefabrication and rolling the sections of the bins in place. We were particularly interested in this operation, because we have a somewhat similar job coming up in the near future, in which we have to replace a section of wood trestle with steel. I would like also to comment briefly on the stock and lining removal in the furnace. Mr. Daniels did not state if any particular method was used to speed up these operations. We at Hanna furnace wash out the stock in the furnace. This is facilitated by using a blow out burden of a mixture of furnace coke, nut coke and sinter, keeping the furnace full up to the last cast, after which the furnace is wet down by water sprays on top. The furnace is thoroughly wet down for about twelve hours, after which the stock is washed out through two cooler openings, into hopper cars, by the use of high-pressure water jets. The furnace lining is removed by using a wagon drill mounted on a hanging scaffold. The wagon drill has had the drifter and drill bit removed. A paving breaker using a long wedge shape chisel is mounted on the boom. The boom of the wagon drill is mounted on an air cylinder so that controlled vertical movement is available. The boom on the wagon drill can also be moved horizontally in a circle. The mechanism takes two men to operate it; one to work the air cylinder up and down, and the other to operate the buster. Four other men are used to rake the brick off the shelf and down into the furnace. This has provided a rapid and labor saving method for removing the old lining. In connection with the brick laying, I would like to have Mr. Daniels comment further on the method of mixing and forcing the slurry to the top of the furnace with air pressure. Was this equipment made in their shops, or purchased from an outside manufacturer? How much air pressure is required? I would also like to comment on the shock scaffold. We do not use a shock scaffold in our blow in practice. We understand this scaffold is used to support the burden at some point above the tuyeres, during the period when ignition is taking place. How far up in the furnace is this scaffold located?

The whole job of relining a furnace is one that takes much preparation and teamwork among every department concerned, and I certainly agree with Mr. Daniels that its completion can be well celebrated by maintenance and operating personnel alike.

W. C. Daniels: Coming to the first question, lining up on tear out, tear out was done on a hanging scaffold which was lowered by hoists. The laborers working on the scaffold worked with jack hammers, and threw the brick refuse into the bottom of the furnace. Where we gained a lot of time on that was on the method of waste removal from the bottom of the furnace. Refer to Figure 20 which shows the replacement of a large section of hearth jacket. This section was removed to allow a medium sized bulldozer equipped with a dozer shovel, to go into the furnace. As the brick came down, the dozer went in and took the brick out and backed up and dumped it into trucks, to be carried off to the dump. The idea of the hanging scaffold is not new. In fact, one of the other Bethlehem plants was quite interested in it and we looked up the original drawings. The scaffold was not used originally in a furnace of this size, but was designed in our engineering department in 1907 and used ever since, with variations. In this particular case there was quite a variation, the brick contractor had that part of the job, and this scaffold was part of the contractor's equipment, rather than ours. We had very little delay in our method, or rather, the contractor's method of digging out the brick work. And as to blowing out our practice, because of the safety angle, has always been, for the last, say ten or twelve years, to do exactly as you do over there at Hanna. This was the first furnace that we, to save time in the blowing out of the furnace, blew down to the mantle. It was under the supervision of the blast furnace department, and was very successful. It saved us a lot of hours cleaning out the furnace. I called attention in my paper especially to that slurry tank, and the method of delivering the slurry to the bricklayers. We thought that was an extremely good idea, and judging from the time it took to brick the stack, I am sure it paid off.

The equipment was made in our own shops. It consisted simply of a slurry box and a pressure tank, with the proper fittings for filling the tank, shutting the filling connections off and putting air pressure on the grout mix in the tank thus forcing the mix through piping to the brick scaffold within the furnace. Our air pressure is roughly 100 psi. A similar operation to this has been done many times, especially in marine work, where they do pressure grouting. Our equipment would correspond to pressure grouting equipment. The shock scaffold was started by our furnace department several years ago. It was first tried after there had been bad coke messes and trouble finding the tap hole for the

first cast on several "furnace blow ins." It has been very successful. It is an extremely heavy scaffold because it has to support the burden of the furnace. It is not installed above the tuyeres but is installed about one foot or two feet below the tuyeres. Just when it burns up, or what the action is, I do not believe anyone could definitely state.

A. M. Cameron: I would like a little more elaboration on the safety program during this blast furnace rehabilitating project.

W. C. Daniels: A safety program is a definite necessity and usually a chore when you are trying to get a job of this nature done. In doing a job of this type gaseous areas were present and we had to be extremely careful. There were safety supervisors assigned to the job around the clock and when there was any question about a working area, actual gas analysis for carbon monoxide was taken in that area. We have carbon monoxide instruments that are accurate, if I am not mistaken, to 0.01 per cent. Those were used at regular intervals, until the furnace was out of blast. As I mentioned, the job which was probably one of the most spectacular of all the jobs we had, was in installing walk ways for additional cooling plates. On our operation, we were extremely careful to see that the gas concentration was not such that a man could not stand to work in one of those places. I believe any furnace operator in this area has realized the same as we have that wind direction means a lot. We have worked the west side of the furnace when the wind was in the west, and there were many days we were wishing that Buffalo had more easterly winds than they do. In doing this job, we had fellows get headaches, but I believe there was just one occasion where a man was gassed to the point where he had to go to the dispensary. It was pretty cold in March on the furnace, with the winds the way they were. This man went inside of the cast house above the bustle pipe to get warm and passed out, he did not lay there very long before he was found and had to be taken down.

Along the safety angle, we had no lost time accidents on that furnace, in spite of the accelerated job, and in fact, doing a lot of the job while the furnace was in blast.

Stanley J. Sarek: I would like to know about the masks you used on the job wherever you had gas present. Did you use air packs or work units, where you pumped air from the atmosphere into the mask, or did you use a chemical mask?

W. C. Daniels: Most of our masks are the standard type and are oxygen masks. What our safety department has done on that work is to have manifolds and attach a number of masks to a number of oxygen tanks through a manifold, and the masks were all the nosepiece type, not the full mask. Also, any of you who are interested in gas masks may or may not know that where there are freezing conditions, these masks have been known to have frozen, cutting off the oxygen supply. We have had a couple of close calls, but not on this job, however.

Orders Are Now Being Taken for

Tube Mill Practice

A collection of articles from the IRON AND STEEL ENGINEER on various phases of tube making.

Practical information on layout and operation of facilities for seamless, butt and electric weld pipe, a field in which little information has been published . . . 23 articles by 20 authoritative writers . . . invaluable for engineers, operators, trainees and students.

8-¼ x 11-¼ in.,. . . . . 196 pages, illustrated, clothbound

Price: To AISE Members . . . $2.00
To Others $4.00

ASSOCIATION OF IRON AND STEEL ENGINEERS

1010 Empire Building

Pittsburgh (22), Pa.

By R. W. MOORE
Manager Development Engineering
Control Engineering Department
Westinghouse Electric Corp.
Buffalo, N. Y.

THE MAGNETIC AMPLIFIER IN CONTROL CIRCUITS

. . . . the magnetic amplifier has found many applications where it helps the steel producer to make better steel . . . .

▲ IN its simplest form the magnetic amplifier is a variable reactance between a source of alternating voltage and a load. A relatively small amount of d-c power varies the reactance by saturating the magnetic core and thus controls the large power to the load. However, the art has progressed far beyond the implication of this simplified description, particularly when the magnetic amplifier is used as a component of a regulating system.

Many magnetic amplifier circuits have been devised, each having advantages for a particular type of application. A recent bibliography, "Bibliography of Magnetic Amplifiers and Saturable Reactor Art," by Jones G. Mills, Trans AIEE, 1952, lists nearly 900 patents and articles covering saturable core devices and magnetic amplifiers. Although saturable reactors have been used as amplifiers for 35 years, several more recent developments have made possible the fast, flexible, and powerful control device of today. First, was the self saturating circuit which raised the ratio of power gain to the response time by the factor of 100. Second, was the development of magnetic material which gave high gain with high output. Third, was the development of selenium and other dry type rectifiers which function to improve gain, stability and reliability of this device.

THE HALF WAVE SELF SATURATING MAGNETIC AMPLIFIER

Figure 1a is a schematic diagram of a half wave self saturating magnetic amplifier. The amplifier consists of reactor having a magnetic core with a load winding and in series with this winding is a source of alternating voltage, a rectifier, and a load. On this reactor core is a control winding energized from a source of d-c voltage. This circuit as shown is not practical because an a-c voltage would be induced in control winding, therefore, a high impedance would have to be used in the control circuit to limit a-c current flow. However, the circuit can be used to illustrate the action of a magnetic amplifier. The reactor is designed such that it can absorb the maximum value of applied a-c voltage permitting only a small amount of exciting current to flow. The rectifier in the load circuit prevents reversal of a-c current during the negative, opposite to rectifier half cycle of voltage. During the negative half cycle, the flux density in the core is determined by the value of current in the d-c control winding. During the positive half cycle the reactor absorbs voltage until the core saturates at which time the reactance becomes a minimum and a pulse of load current flows. The point

at which the core becomes saturated is determined by the value of the current in the d-c control winding.

Figure 1b is an oscillogram of supply voltage and load current for one value of d-c control current. Note that the reactor absorbed the supply voltage for approximately half of one positive half cycle of supply voltage. At this point, the core saturates and permitted a load current to flow. In order to obtain a minimum load current it is necessary to apply a negative current to the d-c control winding such that the reactor is held at essentially full negative saturation flux

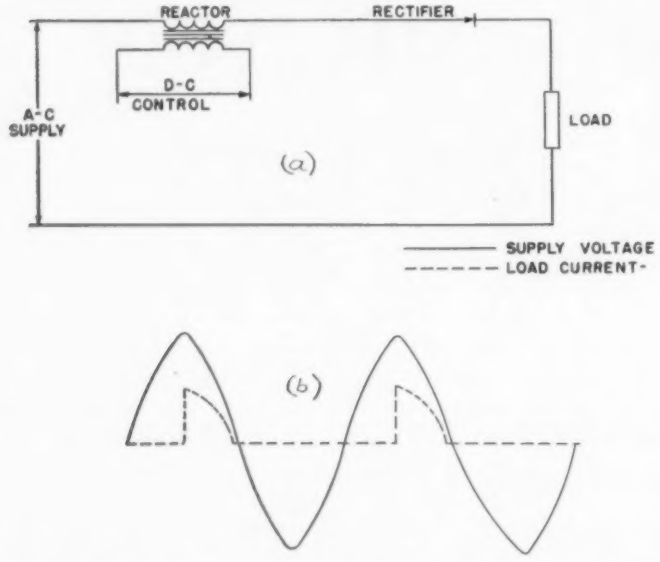


Figure 1 — Half wave self saturating magnetic amplifier circuit is shown in (a) and wave form is shown in (b).

density, therefore, permitting the obtaining of maximum reactance and minimum load current. To obtain a minimum reactance, a positive control current is required which holds the reactor at essentially full positive saturation thus no appreciable flux change is obtained in the reactor during a positive half cycle of voltage and the reactance is a minimum, and load current flows for approximately a full half cycle of the positive half wave of high voltage.

PARALLEL SELF SATURATING MAGNETIC AMPLIFIER

In addition to the fact that a voltage was induced in the control winding of the reactor as shown in the circuit of Figure 1a, such a reactor permits the current to flow only in alternate half cycles of the supply voltage. Both of these effects can be eliminated by the use of the two reactors and rectifiers in parallel as shown in Figure 2. Such a circuit permits connecting the control winding in a series in a manner to cause the induced voltages in the control winding to cancel out. One load winding circuit carries current during the negative half cycle as determined by the direction of the self saturating rectifiers, thus a full wave operation is obtained. Figure 2 shows a bridge rectifier inserted in the load winding circuits to obtain direct current output to the load.

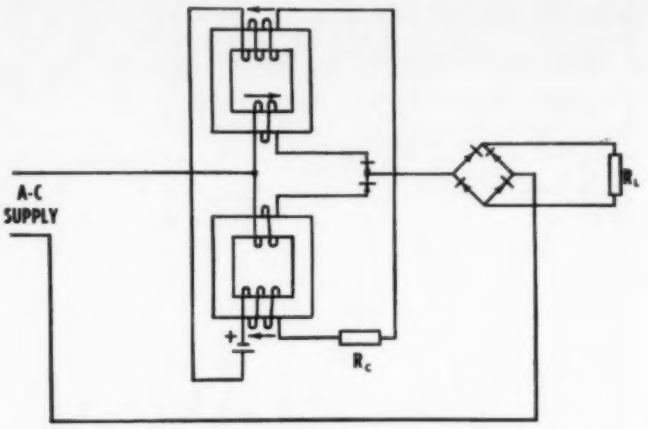
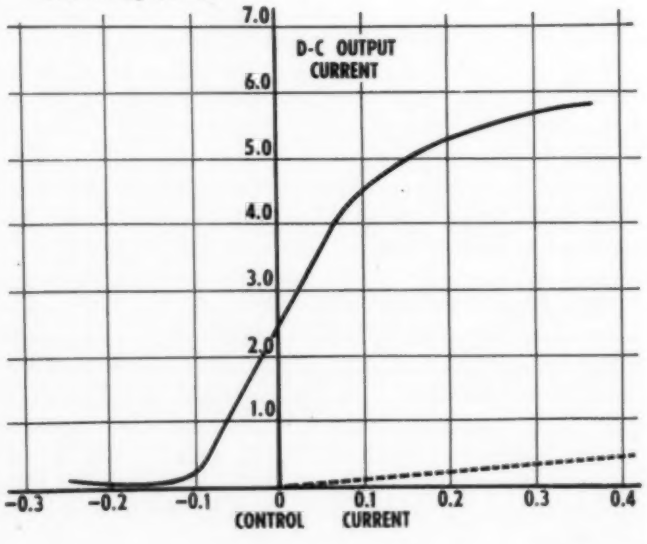


Figure 2 — Parallel self saturating magnetic amplifier consists of two reactors and rectifiers in parallel.

The control characteristic for the magnetic amplifier circuits of Figure 2 is shown in Figure 3. This is a curve of d-c output current plotted as ordinates and d-c control current plotted as abscissa. The straight line portion of the output current curve from approximately 0.2 to 4 amp output current represents the useful operating range for a control system. Note that the control current varies from approximately −0.1 amp to +0.1 amp for this range of output current. This is a typical curve of magnetic amplifier performance and in particular is a curve for a Type C hipersil core magnetic amplifier. The dotted curve shown at the bottom of the curve sheet is the approximate performance of this same device as a simple saturable reactor without self saturating rectifiers. A comparison of these two curves shows a tremendous increase in gain obtained by the use of self-saturating rectifiers. Since the control current required to control a reactor so used from minimum reactance to maximum reactance is reduced to a very small value, reactors having cores of material having more or less square wave hysteresis loops give higher gain, lower minimum output current, and have sharper curvature as maximum current is approached.

This curve also illustrates that with a d-c load rectifier used to obtain d-c output current, that current flow

Figure 3 — Magnetic amplifier control characteristics are shown by curve.



and power flow is uni-directional. In order to obtain d-c reversible power two sets of amplifiers such as illustrated in Figure 2 must be used in so-called push pull operation. A number of circuits have been devised to obtain operation in this manner. If magnetic amplifiers are used to excite d-c generator field, two separate fields can be used, each supplied from a seperate amplifier. A resistor network can also be used, however, its maximum efficiency is of the order magnitude of 16½ per cent and, therefore, is not used except at lower power levels.

MAGNETIC AMPLIFIER PANEL

A typical amplifier panel is shown in Figure 4. This panel contains two magnetic amplifiers connected in cascade to form a 2-stage amplifier. The first stage mag-

Figure 4 — Magnetic amplifier panel shown is typical.

netic amplifier is located in the upper center between the two sets of adjusting resistors. The reactors for the second stage are shown on the left and right hand side lower center. The schematic diagram of each is shown in Figure 2 and the output of the first stage supplies the control field of the second stage.

ADVANTAGES AND DISADVANTAGES OF MAGNETIC AMPLIFIERS

The principal disadvantages and advantages of magnetic amplifiers are listed in Table I. When applying magnetic amplifiers in industrial control circuits, these advantages and disadvantages should be compared with similar factors pertaining to either rotating or electronic amplifiers. Obviously, it is not possible from such a list of characteristics to state a general conclusion regarding the choice between the magnetic amplifiers, electronic amplifiers, and rotating amplifiers. Rather, a consideration of a number of successful applications of magnetic amplifiers will serve to illustrate how these advantages may be made use of and that the effect of any disadvantages minimized.

TABLE I
Magnetic Amplifiers

Advantages	Disadvantages
1. Long life	1. Uni-directional energy
2. Low maintenance	2. Non-reversible output polarity
3. No warm up time	3. Residual output with zero control
4. No moving parts	
5. High power amplification	
6. Isolation of input signals	
7. Withstands shock and vibration	

REEL DRIVE CURRENT REGULATOR

Figure 5 shows a schematic diagram of a single stage magnetic amplifier used as a regulator to maintain constant strip tension for a reeling operation with core

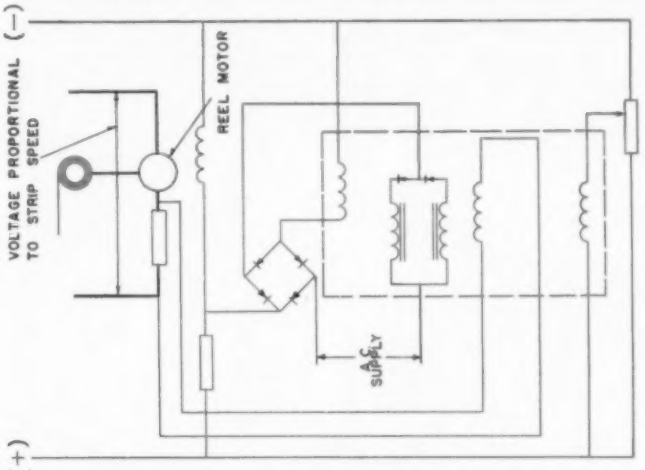
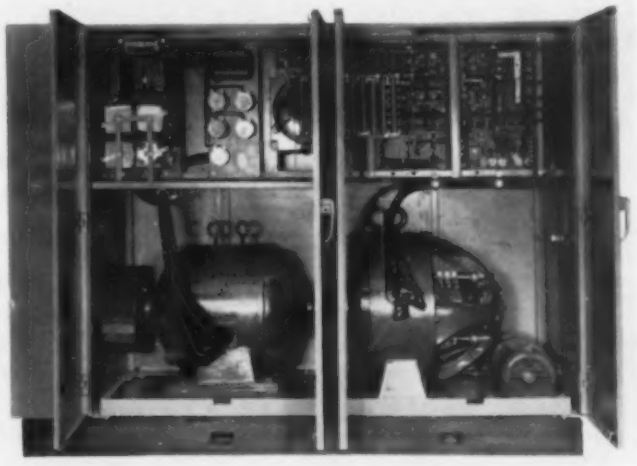


Figure 5 — Magnetic amplifier reel drive maintains constant strip tension.

type reel. The reel drive motor is supplied from a voltage proportional to strip speed. By controlling the motor field current, the regulated value of armature current is maintained. The motor field current is changed as the strip builds up on the reel from weak field at empty reel to full field at full reel and thus the motor torque is increased and the motor speed decreased as the material builds up in the reel core, and essentially constant strip tension is maintained. This is an ideal application of a magnetic amplifier since it

Figure 6 — Package drive control is compact.



is only necessary to add to the fixed minimum value of motor field current during the period of operation. The polarized output of magnetic amplifiers is actually advantageous in this case since it would be necessary to provide such polarized output if a rotating amplifier were used in order to eliminate the possibility of reducing the motor field strength to zero or reversing the field strength completely.

Figure 6 is a photograph of a package drive control using such a reel drive current regulator. Several of these reel drive current regulators have been in operation for some time and are giving excellent performance.

SPEED FOLLOW UP SYSTEM

Figure 7 shows a simplified schematic of a speed follow up system employing a tachometer generator as a signal pickup, a reference voltage, and a control and power magnetic amplifier to control a booster in series

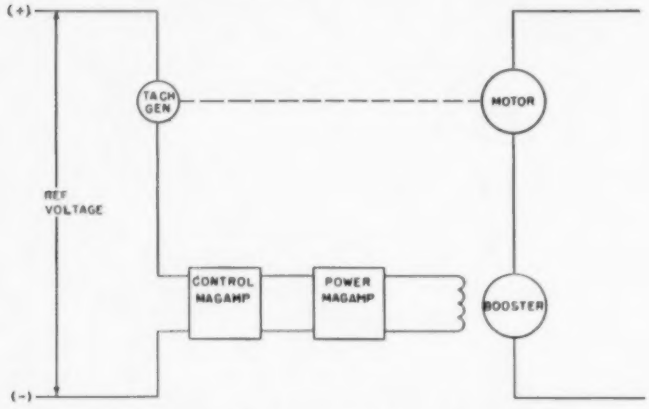


Figure 7 — Schematic diagram of speed follow up system.

with the motor whose speed is being controlled. This system was applied to a steel mill processing line. It is necessary to control the booster voltage in both directions. Thus, a two channel magnetic amplifier supplying two separate fields on the booster was required. The booster is normally operated at a slightly positive voltage. For this application the booster was designed to have a straight line saturation curve to approximately twice the IR drop of the motor armature circuit in which it was placed, and therefore the field excitation requirements were such that no difficulty was experienced in putting two fields on this booster and a two channel magnetic amplifier could be used. This particular installation is illustrated in Figure 8. The magnetic amplifier panel is at the lower left hand corner.

MAGNETIC AMPLIFIER CONTROL FOR TANDEM COLD MILL

Modern tandem cold reduction mills consist of three to five roll stands for cold reducing hot rolled sheet to sheet or tinplate gauges. The material enters the mill from a coil box and is delivered to a core type reel for coiling. Modern practice is to install an individual adjustable voltage drive for each stand and tie these individual drives together by means of a master

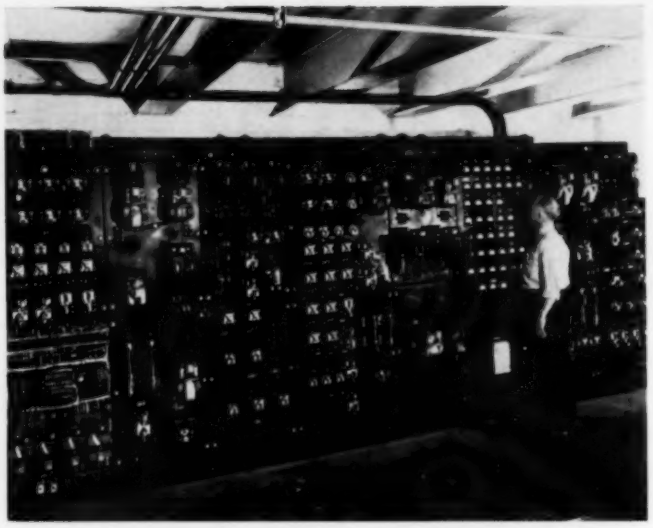
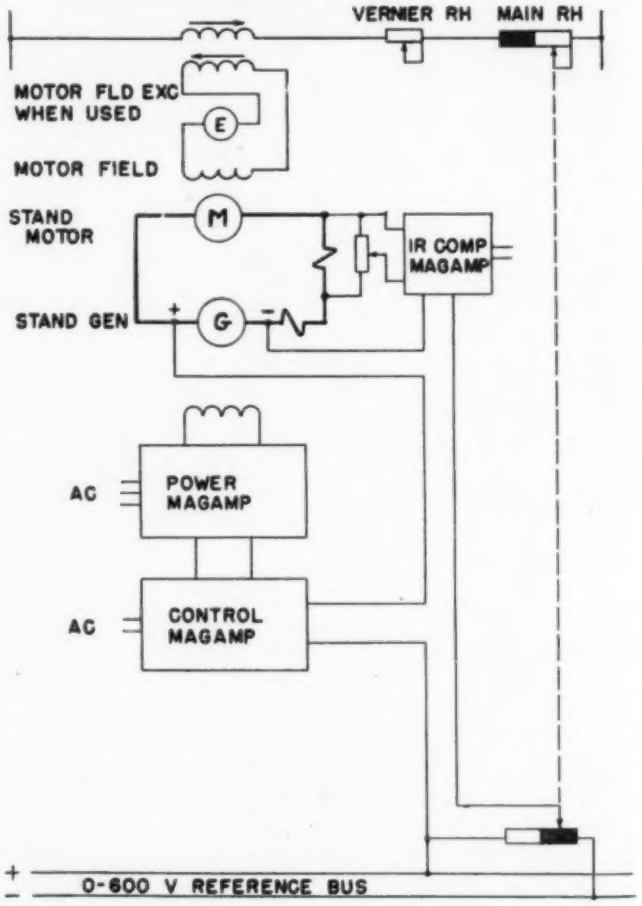


Figure 8 — Actual installation of a speed follow up system.

reference bus and precise fast response regulating systems. These regulating systems maintain correct speed relationships between individual stands in order to maintain tension and reduce the strip gauge in the individual stands. Figure 9 is a schematic diagram of an individual stand drive and its regulating system which uses magnetic amplifiers. The generator voltage is matched to a master reference bus and the difference is applied to a control field of a control magnetic amplifier. The output of the control amplifier excites the

Figure 9 — Schematic diagram of magnetic amplifier regulator system for tandem mill drive.



winding of a power magnetic amplifier which in turn controls the generator excitation in such a way to reduce to a minimum the difference between the generator voltage and the voltage of the master reference bus. By means of a regulating system of this type, the generator voltage of each drive for each individual stand is forced to follow the master reference bus voltage as it is raised or lowered to accelerate or decelerate the mill. An IR drop compensation signal is obtained from separate magnetic amplifier and this signal is introduced into the control field circuit of the control magnetic amplifier to increase the generator voltage with load. A control system of this type has been successfully tested and has proved to be exceptionally fast and accurate.

RESPONSE OF CONTROL SYSTEM

A stringent test of a control system as illustrated in Figure 9 is to instantaneously change the reference bus voltage from one value to another and record the difference between the generator voltage and the reference voltage. The results of such a test are illustrated in Figure 10. The trace marked "Error Volts" is the difference between the generator voltage and the reference voltage. The instantaneous increase in error volts represents the change of 2 per cent in reference voltage. Following this increase in error volts, a period of ap-

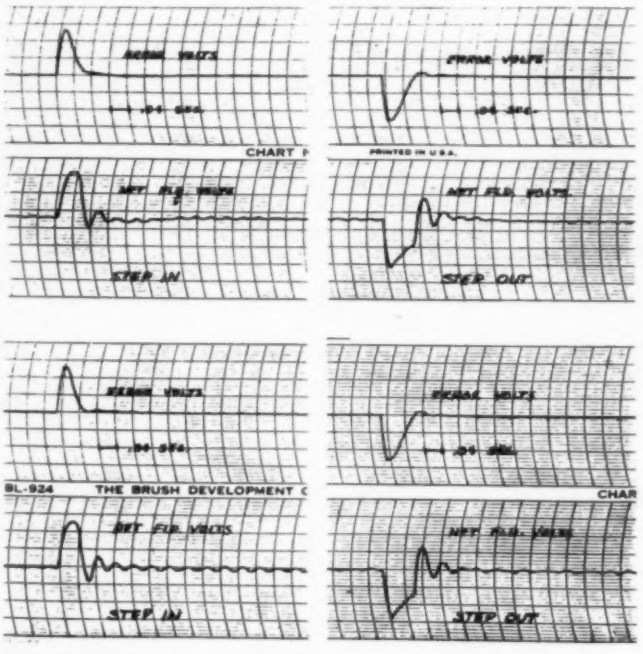


Figure 10 — Tandem mill magnetic amplifier control gives fast response.

proximately 0.1 sec is required for the control to change the generator to match the reference and reduce the error voltage to essentially zero. This is an extremely fast response. A second trace marked "Net Field Volts" is the net excitation voltage applied to the generator during this change. A maximum of 465 per cent of net operating excitation voltage is obtained to force this extremely rapid response of generator voltage.

A 400-cycle supply was used to obtain the ultimate in response and accuracy for this regulating system since the time constants of magnetic amplifiers are less proportionally as the supply frequency is increased. Thus a 400-cycle magnetic amplifier has possible minimum time delay approximately one-seventh of that of a 60-cycle magnetic amplifier. Although 60-cycle magnetic amplifiers have proved successful for most industrial applications, when the ultimate in response is required higher frequencies can be used.

THE MAGNETIC AMPLIFIER CABINET

Figure 11 shows the front of a magnetic amplifier control for an individual stand drive of a tandem cold

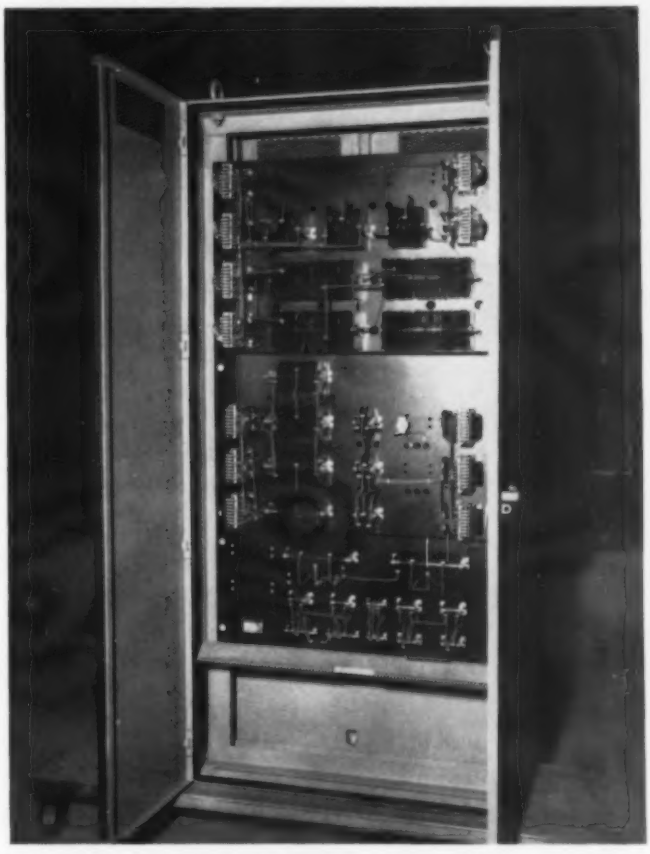


Figure 11 — Tandem mill magnetic amplifier control cabinet provides ready access.

mill. This view shows the reactors and rectifiers for the power stage and the rectifiers for the control stage and the IR compensation magnetic amplifiers.

THE MAGNETIC AMPLIFIER AS A CURRENT LIMIT DEVICE

Adjustable systems are often built with voltage regulators which are so designed as to force the generator voltage to change a very high rate. For a drive so designed under certain conditions of operation, it is often possible to exceed the safe maximum torque and current limits of the d-c drive motor. By combining a current limiting circuit with the voltage regulator it is possible to obtain maximum rates of acceleration and deceleration and still maintain certain safe limits of torque and current over the greater portion of an accelerating or decelerating cycle. Such a system is illustrated in Figure 12. The voltage regulator consists of a

magnetic amplifier and a rotating regulator. The current limit (C.L.) magnetic amplifier is designed so that its minimum output current is essentially zero. The magnetic amplifier has a bias coil so connected as to apply negative ampere turns to its core to reduce its output to essentially zero. It also has a current coil having ampere turns proportional to the load current of the motor connected in such a way as to apply positive ampere turns to the core. The magnetic amplifier under these conditions will not have any output until the control ampere turns proportional to motor armature current exceeds those ampere turns of the bias

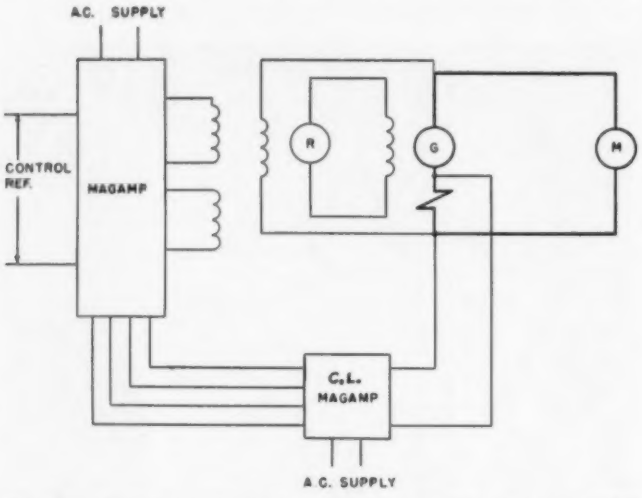


Figure 12 — Schematic for current limit control with magnetic amplifier.

winding. When designed with high gain then it is possible to obtain a change of output from zero to maximum with a small additional amount of current coil ampere turns. This output is applied to the voltage regulator in such a direction as to oppose the action of the control reference applied to the generator voltage regulator. In this way the generator voltage regulator can be built with extremely high forcing which will force the generator voltage and therefore, the motor current to high values. When the motor current has exceeded the safe limit for which the current limit magnetic amplifier has been adjusted, the action of the voltage regulator will be modified by the current limit amplifier to reduce this current to a safe value. If rated voltage and speed of a drive is required in both directions of rotation, it is generally preferable to use a rotating amplifier for the voltage regulator. The static volt ampere characteristic of the circuit of Figure 12 is shown by the curve of Figure 13. The shape of this curve can be modified by adjustments of the current limit magnetic amplifier.

Figure 13 — Static volt-ampere curve is shown for magnetic amplifier current limit control.

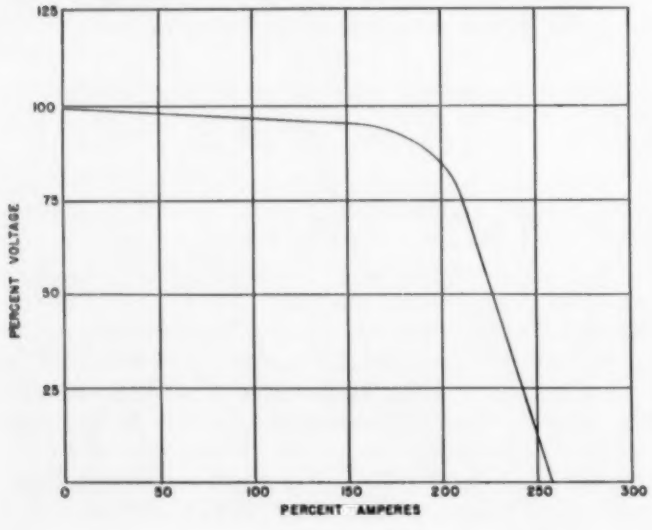


Figure 14 is an oscillograph trace of the transient performance of the circuit illustrated by Figure 12. By applying instantaneously full control reference voltage to accelerate the drive from zero to rated speed, the

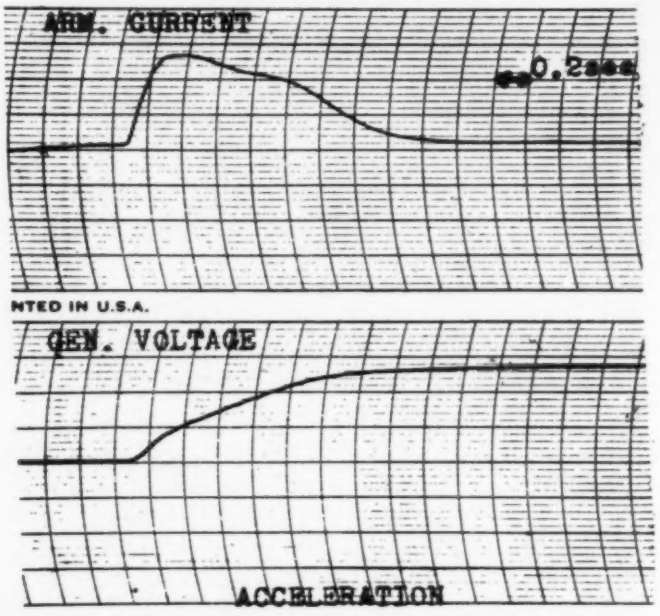


Figure 14 — Transient response of magnetic amplifier current limit is shown by oscillograph.

equivalent of throwing the master switch from the "off" position to full "on" is obtained. Traces of motor armature current and generator voltage have been made. The limit value of current or slightly more is maintained for a large per cent of the accelerating time.

The control for a processing line is shown in Figure 15. On the two lower panels in the cabinet are mounted the magnetic amplifier regulators for a current regulator on a drag generator and the main generator voltage regulator with current limit.

MAGNETIC AMPLIFIER TENSION REGULATOR

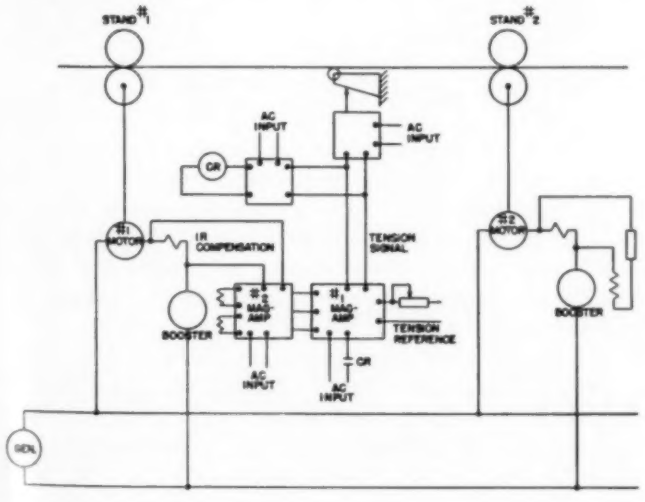
Figure 16 is a schematic diagram of a magnetic amplifier tension regulating system to control the strip tension between Stands 1 and 2 of a two stand skin pass mill. A high gain two channel magnetic amplifier is an ideal choice for this system since the output of the tensiometer magnetic pickup head is quite low and this output must be amplified to provide excitation for a booster for the first stand motor as illustrated in the schematic diagram. This booster modifies the voltage applied to the first stand motor armature as deter-

Figure 15 — Control cabinet with magnetic amplifier voltage regulator and current limit is used for processing line.

mined by the regulating system, therefore tension between Stands 1 and 2 is controlled. Although the regulating problems of this system are more complex, the magnetic amplifiers are the same as illustrated in Figure 2.

There is another interesting application of a magnetic amplifier on this system. It is not possible to have the tension regulator in operation when the strip end is between Stands 1 and 2 but not threaded into Stand 2 or as the slip leaves the mill. Considering the threading operation, as soon as the strip enters Stand 2, it is pulled down on the tensiometer roll at which time it is

Figure 16 — Magnetic amplifier tension regulator system is used to control strip tension between two stands of a 2-stand mill.



desirable that the tension regulator be energized and take control. This can be accomplished by applying a sensitive relay system employing a magnetic amplifier to detect a small change in the output of the tension pickup device. The magnetic amplifier used for this application is so designed that a small change in input control will cause the magnetic amplifier to suddenly change its output from minimum to maximum thus picking up the relay which applies the regulator. A similar reduction in control amperes will reduce the magnetic amplifier output from a maximum to minimum, thus permitting the relay to drop out and remove the regulating system if the strip should break. By using the magnetic amplifier a rugged industrial type relay can be used in the control circuit.

MAGNETIC AMPLIFIER IGNITRON VOLTAGE REGULATORS

Magnetic amplifiers are used to control the firing of ignitron rectifiers and thus regulate their voltage output. A magnetic amplifier for this application is illustrated in Figure 17. Three such units are being supplied to regulate the voltage of three 8000-kw bus sections

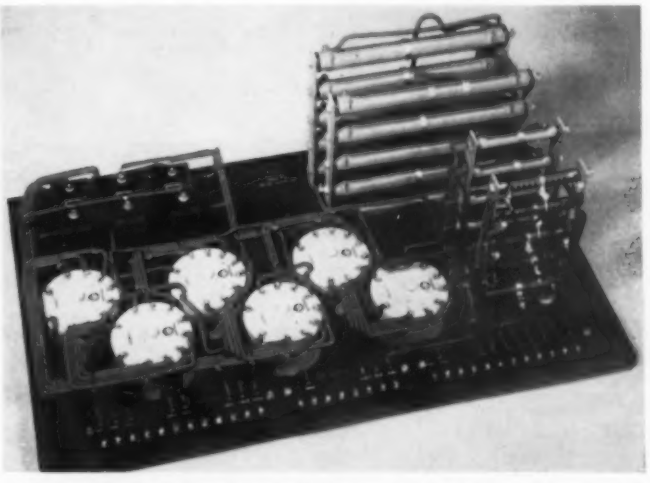


Figure 17 — Magnetic amplifier controls firing of ignitron voltage regulator.

supplying power to the finishing train of a hot strip mill which will be installed soon.

Use of magnetic amplifiers in a variety of applications has been described. It is evident that the control engineer has a powerful new tool which takes its place along with the electronic amplifier and the rotating amplifier for use in control circuits. It is not meant to imply that the magnetic amplifier will supersede either electronic or the rotating amplifier. For a given application a choice of one of three types of amplifiers can be made. Such a choice is made on the basis of the characteristics, the advantages, and disadvantages of each type. Occasionally, it will be advantageous to combine any two of the three types of amplifiers. However, as time passes many more applications other than has been described will be made. Whenever the magnetic amplifier is employed its use will permit the electrical industry to assist the steel industry in producing more and better steel.

WIDE RANGE METERING OF OXYGEN IN STEEL PLANTS

By MARSHALL S. GARE
Manager, Ring Balance Division
Hagan Corp.
Pittsburgh, Pa.

. . . . the meter described provides good accuracy at very low as well as at high flows . . . .

▲ THE ever increasing use of oxygen in steel plants has created considerable interest lately in wide range metering systems. One of the reasons for this interest is the flow pattern peculiar to oxygen which occurs in many plants. This pattern exhibits repeated cycles of short duration, but extremely high flow rates which are superimposed on the normal flow rates, the latter constituting a variable load itself. The chief cause of this unusual pattern is the oxygen consumed by automatic scarfing machines. Both the buyer and the seller of the oxygen are satisfied only when the instruments which tick off the dollars—like the filling station gasoline pump—are trustworthy. The metering system, therefore, has to be the umpire.

Assuming an oxygen cost of roughly 25 cents per 100 cubic feet, a plant using 800,000 cu ft per 24 hours has a bill of $2,000 a day. Yet the total integrated reading of the oxygen consumed in such a plant may be a 24 hour average of from only 5 to 10 per cent of the capacity of the metering system. Such a system must measure oxygen as reliably at 500 cfhr as it does at 400,000 cfhr (a ratio of 800 to 1), and it must be fast enough to register and integrate at either of these extremes on one or two seconds notice and for a duration, perhaps, of only a few seconds at either rate. The metering system must be entirely automatic and it must produce an integrated daily reading corrected for pressure and temperature variations. The description of such a system is the subject of this paper.

Before describing the system and how it operates, a few words explaining the metering instruments used may be helpful. The flow meter used for the oxygen measurements described here is the ring balance type.

The ring balance flow meter is a radial torque meter which uses a hollow ring body to convert the differential pressure generated by flow through an orifice into a rotation which is transmitted to the recorder. Figure 1 shows the ring assembly in a typical flow measuring instrument. On left is indicated the position of the ring body at zero flow condition, and on the right is shown the ring position at maximum flow condition.

The meter operates in the following manner:

The ring assembly is mounted on a knife edge bearing which permits rotation about the axis of the ring. The ring is divided into two pressure compartments by the baffle at the top, and by the sealing liquid which fills the lower part of the ring. The two ring compartments thus formed are connected to the pressure pipes by means of flexible tubing to permit free rotation under action of the differential pressure.

The ring rotation is transmitted to the recording pen through the cam and suitable linkage. The cam contour imparts a movement to the recording pen which is directly proportional to the flow rate, thus giving a uniform flow chart.

Ring torque is a function of the differential pressure acting on the baffle. The baffle areas of the various rings are proportioned to produce approximately the same operative torque within the recommended differential limits. This torque is resisted by the leaf

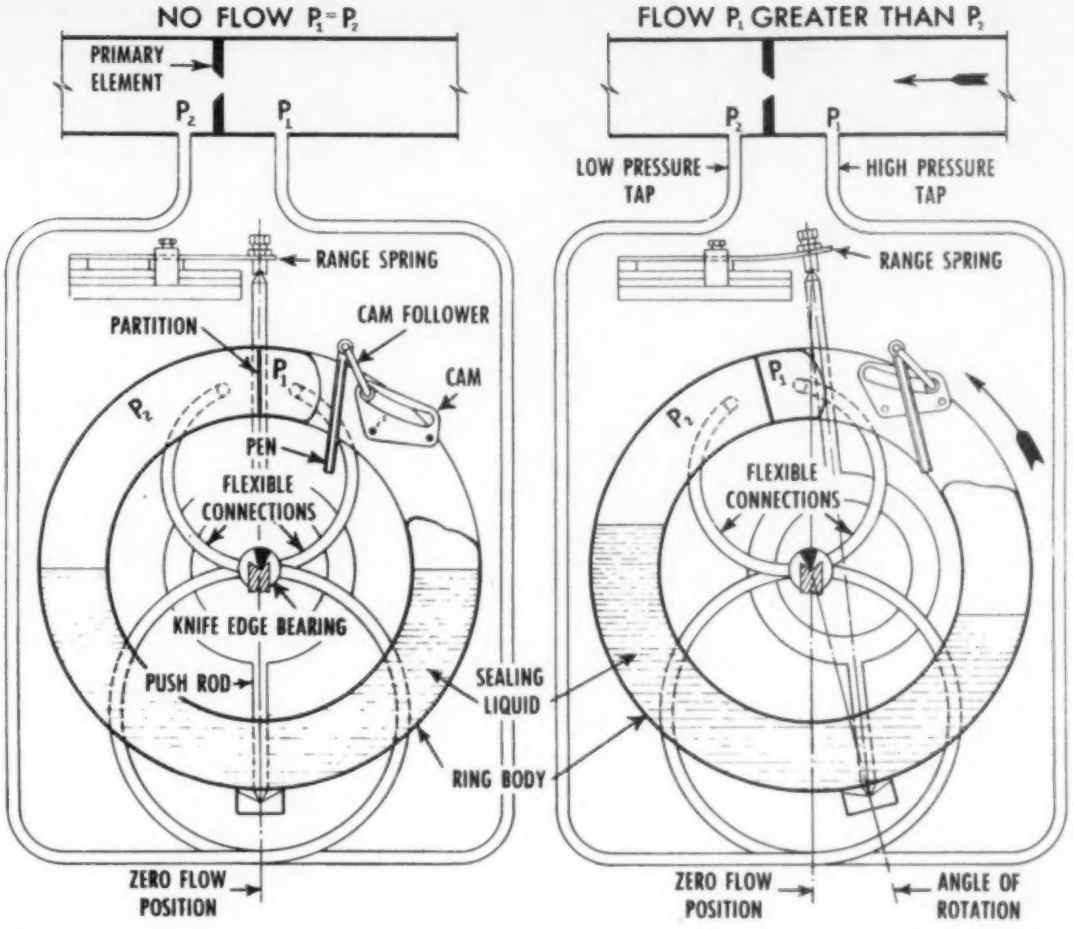
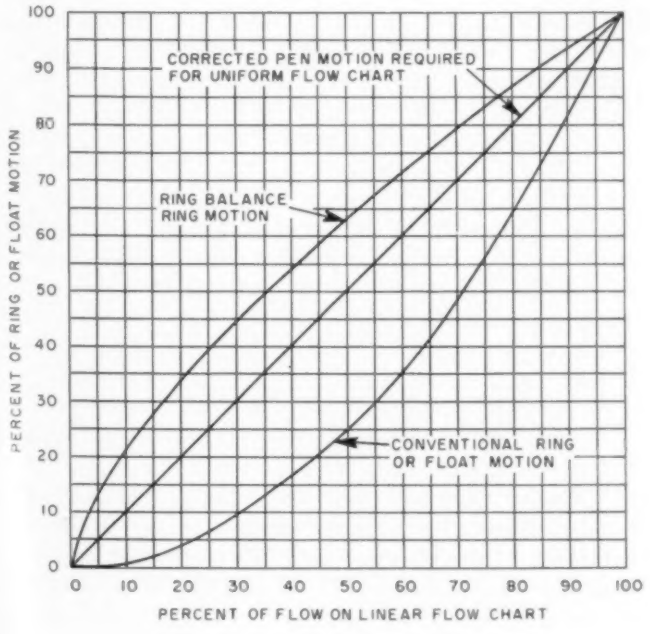


Figure 1 — Principal of operation of ring balance meter is illustrated by these two sketches.

spring system located above the ring and is transmitted through the push rod assembly. The meter is an equilibrium when the ring torque is balanced by the spring force.

The resistance system is unique in that it maintains good accuracy at low flows. As shown in Figure 2, in the ring balance meter, the motion of the ring at low flows actually produces an over-magnified flow reading. The correction of this over-magnification, however, is obtained with a cam, the slope of which is very gradual throughout rather than being steep at the low end, thus giving a significant increase in the mechanical accuracy and sensitivity at low rates of flow. In float type meters, as shown, the motion of the meter element at low differentials must be magnified to produce a linear flow chart. Hence the difficulty of obtaining reliable readings at low flows. With the spring resistance ring balance meter, the mechanical advantage is greatest at low flows.

Figure 2 — Curve shows that good accuracy is maintained at low flows.



The mercury or other sealing fluid exerts no force tending to rotate the ring, and acts only as a seal for the differential pressure in the two compartments.

Several advantages accrue from the leaf spring resistance system in the ring balance meter:

1. Reliable readings at low flows.
2. Maximum differential for full scale pen reading can be adjusted over a 7:1 range.
3. Meter is calibrated with check weights instead of water column.
4. No stuffing boxes.
5. Sealing fluid is not critical.
6. High torque to friction ratio.

THE INTEGRATOR

The ring balance integrator operates on a simple principle. See Figure 3. At regular intervals, a pawl ad-

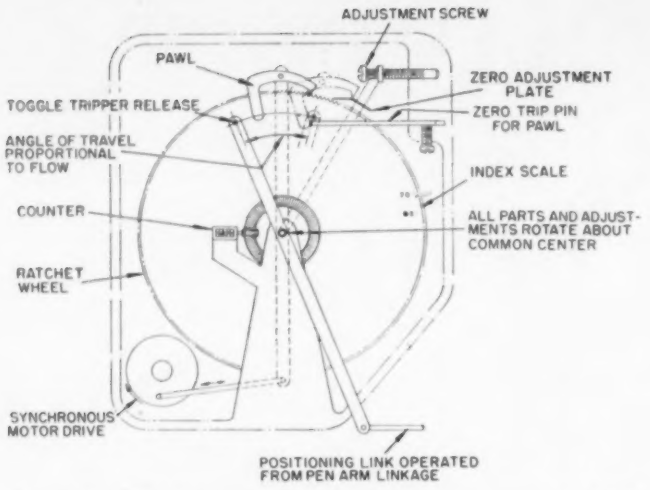


Figure 3 — The integrator mechanism using a pawl which advances a ratchet wheel.

vances a ratchet wheel by a certain number of teeth. The number of teeth advanced by each stroke of the pawl is determined by the rate of flow. The total flow in a given time interval is accumulated by the counter, which is operated from the ratchet wheel, and is an integrated flow reading. The integrator is accurate from 2 to 100 per cent of the meter range.

In the oxygen meters described, the frequency of the integration cycle is once every 7½ seconds.

AUTOMATIC PRESSURE AND TEMPERATURE COMPENSATION

Flow measurement by means of orifice type meters is based on the fact that there is a correlation between the rate of flow and the differential pressure across the orifice. Density of the fluid measured is one of the factors affecting this correlation. Since variations in temperature and pressure affect fluid density, the chart reading must be corrected to compensate for them.

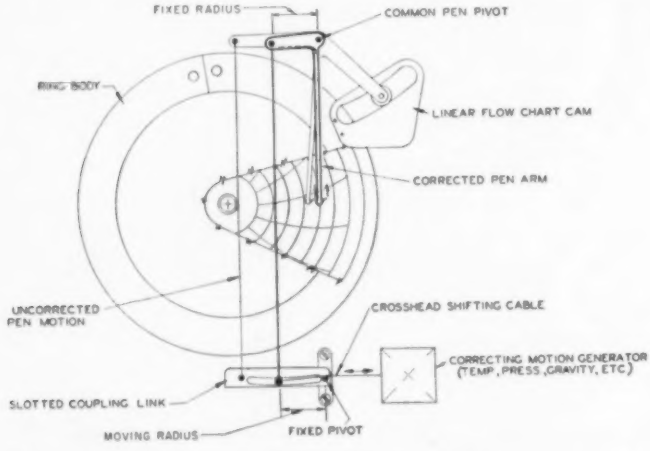


Figure 4 — Temperature and pressure variations in the meters are compensated automatically.

The compensated ring balance meter automatically corrects for variations in temperature or pressure, or both, giving a chart record of the corrected flow. The integrator automatically and continuously totalizes the corrected flow.

In the meter, the correcting variable (temperature or pressure, or both) is transmitted to the correcting motion generator. This assembly positions a crosshead in the slot of a coupling link. This position is related to the change in fluid density and produces a continuous mutiplication of the uncorrected pen movement by a factor which is proportional to the square root of the density of the measured fluid. The corrected pen makes the record of the multiplication. See Figure 4.

SYSTEMS FOR OXYGEN MEASUREMENT

In designing a system for wide range metering, many local conditions should be taken into consideration. Maximum and minimum flows should be known. Base load conditions during week days and week ends also are important. Is the system to measure gas at the generating plant, or is it to measure distribution to various departments? Are special high peak loads to be encountered and what is their frequency? How much space is available for manifold metering runs? How much money should be spent on the system? These and other conditions will help to determine whether the system should consist of one instrument or several. Whatever the conditions, the metering results should be dependable, and the cost of the system should be commensurate with the value of the oxygen which will pass through it over a given period.

Four different designs will be described.

SINGLE METER SYSTEM

The first system consists of a single meter. This meter measures oxygen being fed only to a scarfer on a slab mill and can be classified as a distribution meter. The meter is installed just ahead of the scarfer and has a maximum capacity of 300,000 cfhr. It is pressure and temperature compensated.

Figure 5 shows half of a typical 24-hour chart taken on this instrument. Examination of this record shows that the average rate of slabs scarfed was 24 per hour or one every 2½ minutes. From this chart, not much detail can be obtained regarding the characteristics of the flow or of the meter action itself—aside from the facts that the flow rate is very high, the elapsed time for scarfing each slab is quite short, and that the increase in rate of flow from zero to full flow is very rapid. Although the chart is somewhat spectacular, detailed analysis of performance is not possible.

The next chart, Figure 6, will help to analyze this same flow and meter action better. This entire record represents only one cycle of the previous chart. Time magnification is more than 5000 to 1, and it can be truly termed a "slow motion" chart. This chart revolved at 4 rpm, and it permits tracing the oxygen flow from the start of the billet into the scarfing head until completion of the operation. The cycle begins when the oxygen valve is opened to "preheat," which represents a flow of about 6 per cent of chart. This rate persists for 12 seconds after which the flow is increased to maximum.

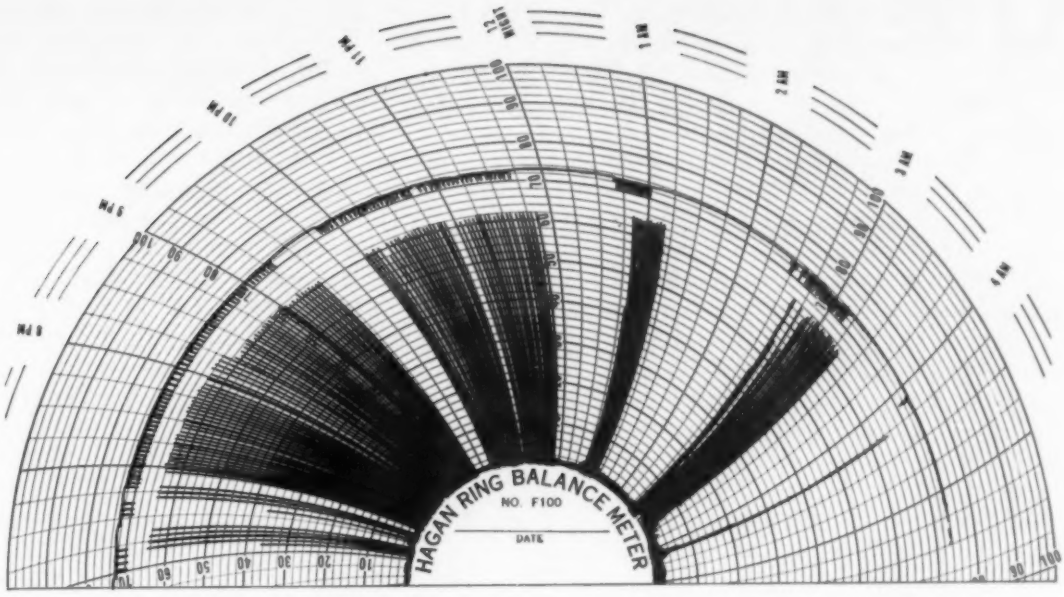


Figure 5 — Typical oxygen flow chart to scarfing machine illustrates the rapid variation in flow which occurs. Chart speed is one revolution every 24 hours.

The pen rises from 6 per cent of the chart to 47 per cent in about 0.2 sec. The pressure reducing valve reaction is extremely fast in bringing the gas down from 150 to about 40 psi, and the meter picks up some of it for about 2 sec and settles out at 53 per cent of chart for 18 sec. The entire scarfing cycle lasts about 30 sec.

This study was made to determine exactly what does take place in a wide range oxygen flow pattern to a scarfing machine and what is required to obtain reliable measurement. Chart rotation was simply speeded up so as to observe the performance of a standard instrument under rather severe flow conditions. Paraphrasing an old adage, "The meter is quicker than the eye," is actually true in this case. It is a picture of what takes place within the meter every time a billet passes through the scarfing head.

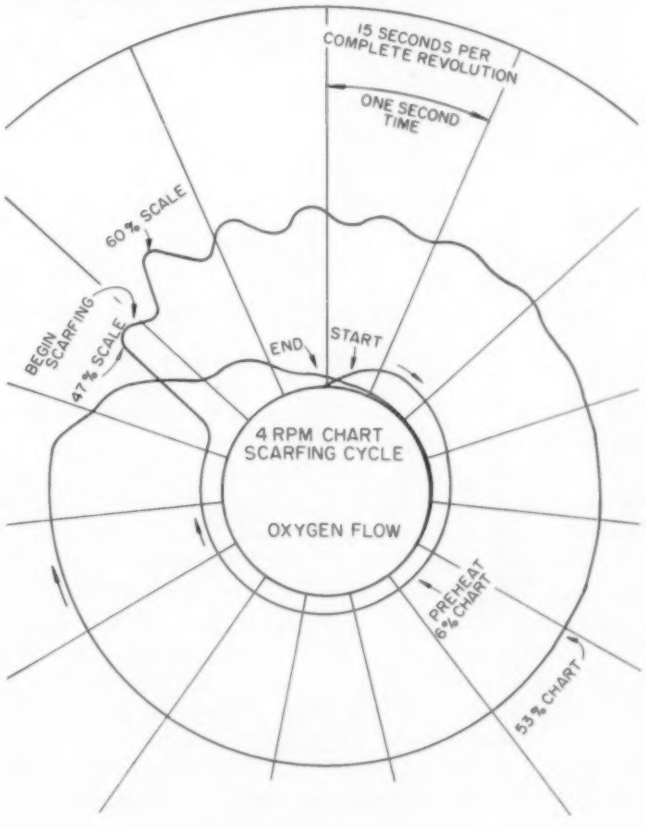
The corollary to the problem of obtaining a satisfactory graphic metering record, is obviously the problem of simultaneous reliable integration. At the time these graphic records were being made, integration studies were also made. As described previously, the integrator samples the flow rate every 7½ sec. The actual integration "bite" or sample, requires from approximately 2 to 2½ sec time. The test for integration is whether the device will function reliably on a rapidly swinging load such as this one is. If an adequate number of samples are taken at constant but adequate frequency and of a magnitude proportional to the varying flowing quantity of gas, a true integrated total should result. This means that integration bites can and must begin on both the increasing and decreasing swings of the register, as well as at normal rates.

The integrator in this meter is driven by a crank pin making a complete 360 degree revolution each cycle. Totalization takes place only on the return half of the stroke. It is logical, therefore, that if two integrators were mounted in the one meter, driven by the same motor, but with the counting strokes occurring 180 degrees apart, they would read exactly the same if they integrate accurately. This test then should prove whether the load illustrated in the charts just shown could be reliably integrated. Two integrators were installed as described and the test made. The 24-hour total readings were within 1 per cent of each other. Total integration for 24 hours on this particular meter average around 7 per cent of the maximum meter capacity.

In this first case of the "one meter system" just described, one meter is adequate to measure this flow because there are only three points of measurement—off or zero position—preheat or 6 per cent flow—and full on or 53 per cent of chart. Multiple meters would not be required because there is no other load.

In the systems that follow, more than one meter is

Figure 6 — Slow motion chart of oxygen flow for one cycle of scarfing operation shown in Figure 5 gives detailed pattern of flow. Chart speed is 4 rpm.



used. However, each instrument may have to perform in much the same manner as the one just described, and in addition measure a variable base load. This base load can be, so to speak, "all over the lot," hence the need for multiple meters.

THE TWO METER SYSTEM

Figure 7 illustrates two meters installed in a manifold—one meter is located in a 4-in. line and the other is installed in an 8-in. line. In this case, the high range meter has a maximum capacity of five times that of the small one. The problem here is to provide a system that will give dependable measurements between a minimum of 20,000 cfhr and a maximum of 1,000,000 cfhr, or over a turn down of 50 to 1.

A pneumatically operated diaphragm valve for open or shut service is located in each line. Air pressure to actuate these valves is controlled by solenoid valves tripped by limit switches within the meters. When oxygen flow is zero, the large line valve is closed and the small line is open. As flow begins, it is measured by the low range meter, and when this instrument reaches approximately 90 per cent of its capacity, a switch is tripped opening the large line valve. The small line valve is then shut off. The high range meter picks up the flow and the low range meter drops to zero. Suitable relays assure the proper sequence of opening and closing the valves. The use of pneumatically operated valves provides cushion and adjustability of the response of these closures. Adequate adjustable overlap of meter ranges is provided to allow each instrument to remain in the measuring position for the maximum possible time.

This is a simple and economical method of obtaining a metering system having a turn down of 50 to 1 with reliable measurements.

Each meter is pressure and temperature compensated so that the chart and integrator readings are in terms of standard cubic feet of oxygen at base conditions of 30-in. mercury and 60 F. Total integration for the 24 hours is obtained by adding the counters of both meters. The design shown in this system illustrates the pressure and temperature elements installed within a separate correction signal generator case. In some instances where only two meters are involved, individual pressure and temperature elements are installed within each meter case and the combined compensation obtained directly.

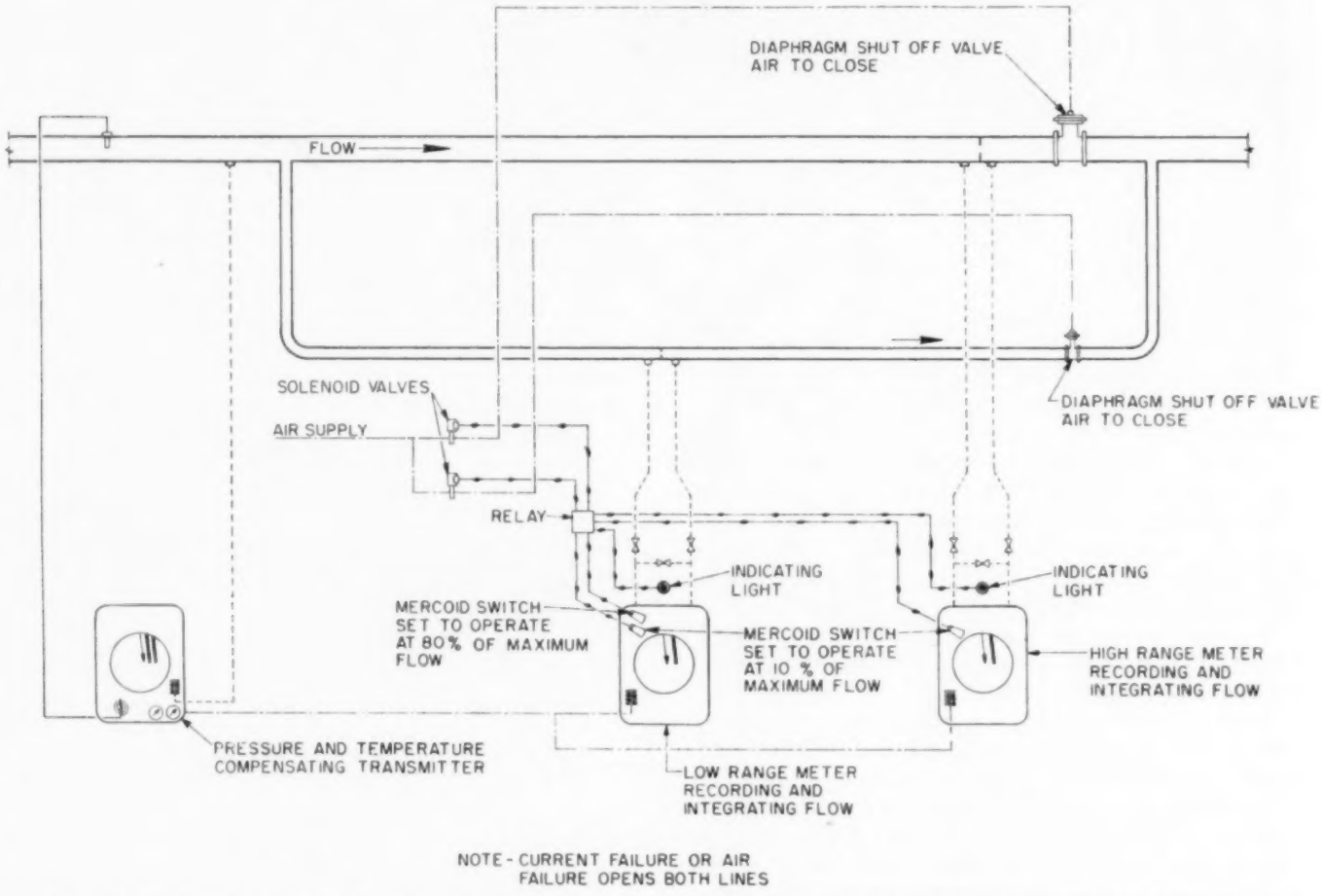

DIAPHRAGM SHUT OFF VALVE
AIR TO CLOSE
FLOW
SOLENOID VALVES
AIR SUPPLY
DIAPHRAGM SHUT OFF VALVE
AIR TO CLOSE
RELAY
INDICATING LIGHT
INDICATING LIGHT
MERCOID SWITCH SET TO OPERATE AT 80% OF MAXIMUM FLOW
MERCOID SWITCH SET TO OPERATE AT 10 % OF MAXIMUM FLOW
HIGH RANGE METER RECORDING AND INTEGRATING FLOW
PRESSURE AND TEMPERATURE COMPENSATING TRANSMITTER
LOW RANGE METER RECORDING AND INTEGRATING FLOW
NOTE - CURRENT FAILURE OR AIR FAILURE OPENS BOTH LINES

Figure 7 — In this installation, the high range meter has a maximum capacity five times that of the smaller meter.

Metering is accomplished entirely by mechanical instruments with the electrical accessories being used only for switching purposes at terminal points.

In the system just described as in the others to be described, failure of either air or power causes the main line valve to open so as to continue to supply oxygen whether it is metered or not.

PILOT METER SYSTEM

The next system illustrated in Figure 8 shows a system having a maximum capacity of 150,000 cfhr. It comprises a main line for high flows and a bypass line for low flows. In the bypass line, there is a single orifice across which two meters feel the same differential. One of these bypass meters measures the lower 25 per cent of the flow and the other measures the upper 75 per cent of the maximum flow through this bypass line. The two meters in the bypass line have capacities of 6,000 and 25,000 cfhr, respectively. The single meter in the main line has a capacity of 150,000 cfhr. Dependable readings are thus obtained from 500 to 150,000 cfhr, or an accurate measuring turn down of 300 to 1.

The low meter in the bypass line is sealed for 100 per cent of the differential that can be generated by the orifice. Since this low meter operates on a lower differential than its companion, the ring diameter is larger so that the torque produced on both instruments is approximately the same.

All of the three measuring meters are pressure and temperature compensated.

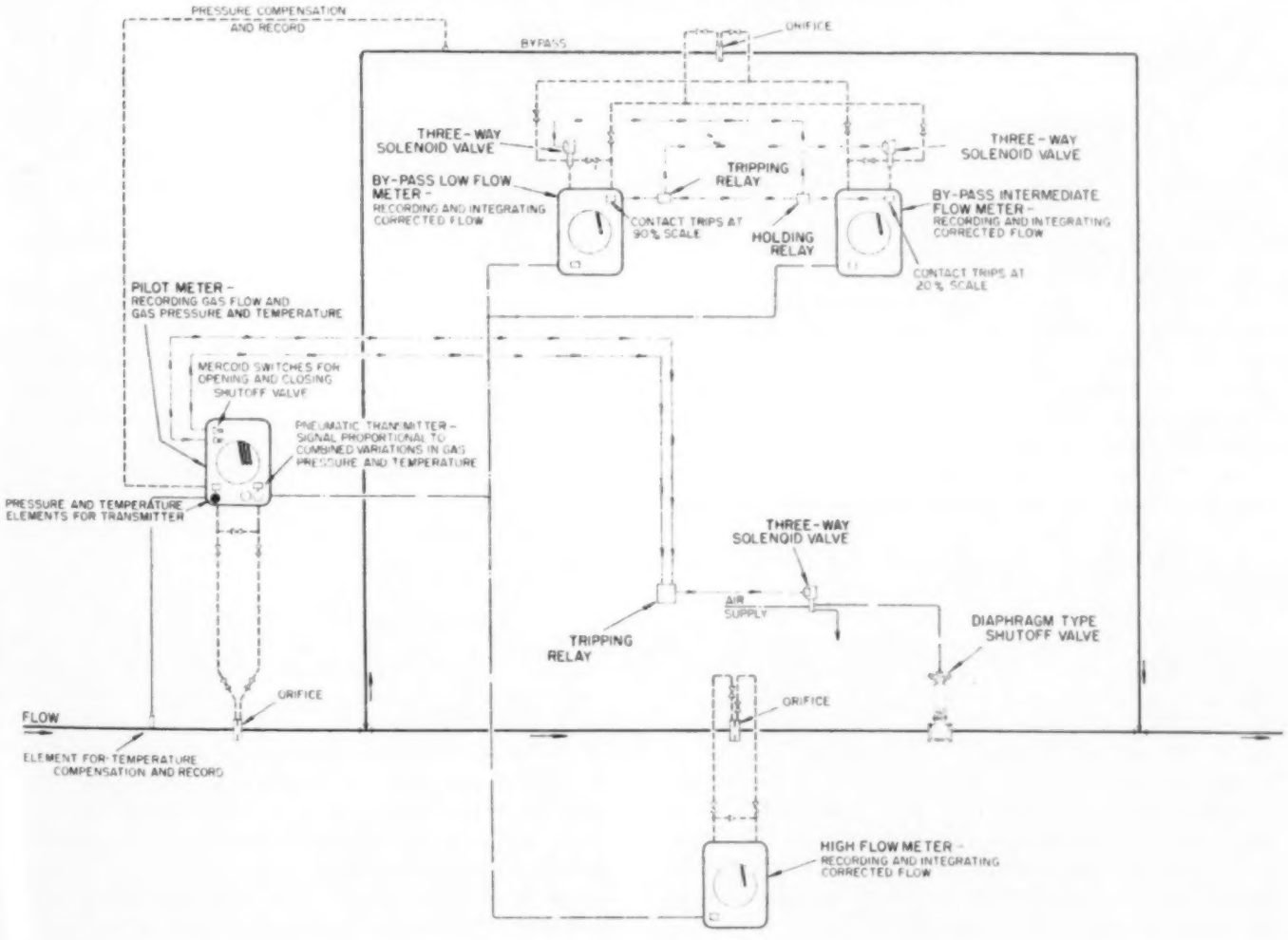
There is an open and shut diaphragm valve in the larger line, and when this valve is closed all low flows of oxygen up to approximately 25,000 cfhr pass through the bypass line. For higher flows, this valve is open and oxygen passes through both lines. There is no shutoff valve in the bypass line, so that when both lines are open, the flow is split between them in proportion to the line sizes, the orifices having approximately the same ratios.

A pilot meter is located in the main line ahead of the bypass. This pilot meter performs two functions: (1) it operates a switch to open and close the high range meter line valve depending on flow demand; and (2) it houses the pressure and temperature compensating signal generator and pneumatic transmitter. Temperature and pressure recording pens may also be mounted in this instrument.

The operation of the system is as follows. With low flow, the large line diaphragm valve is closed and gas passes through the bypass line and is registered on the low meter. When flow reaches approximately 90 per cent of the capacity of this meter, a switch is tripped and the bypass intermediate meter picks up the register and the low meter pen drops to zero. This transfer is effected by the use of solenoid valves in the lead lines of the two bypass meters. Suitable relays permit the low meter to drop to zero as long as the intermediate meter is above approximately 10 per cent of its capacity.

If oxygen flow in the bypass line decreases below 10 per cent of the intermediate meter capacity, reverse switching takes place and real low flows are again measured on the low flow meter.

Figure 8 — This system has a maximum capacity of 150,000 cfhr.


PRESSURE COMPENSATION AND RECORD
BYPASS
ORIFICE
THREE-WAY SOLENOID VALVE
THREE-WAY SOLENOID VALVE
TRIPPING RELAY
BY-PASS LOW FLOW METER - RECORDING AND INTEGRATING CORRECTED FLOW
CONTACT TRIPS AT 90% SCALE
HOLDING RELAY
BY-PASS INTERMEDIATE FLOW METER - RECORDING AND INTEGRATING CORRECTED FLOW
CONTACT TRIPS AT 20% SCALE
PILOT METER - RECORDING GAS FLOW AND GAS PRESSURE AND TEMPERATURE
MERCOID SWITCHES FOR OPENING AND CLOSING SHUTOFF VALVE
PNEUMATIC TRANSMITTER - SIGNAL PROPORTIONAL TO COMBINED VARIATIONS IN GAS PRESSURE AND TEMPERATURE
PRESSURE AND TEMPERATURE ELEMENTS FOR TRANSMITTER
THREE-WAY SOLENOID VALVE
AIR SUPPLY
TRIPPING RELAY
DIAPHRAGM TYPE SHUTOFF VALVE
ORIFICE
ORIFICE
FLOW
ELEMENT FOR TEMPERATURE COMPENSATION AND RECORD
HIGH FLOW METER - RECORDING AND INTEGRATING CORRECTED FLOW

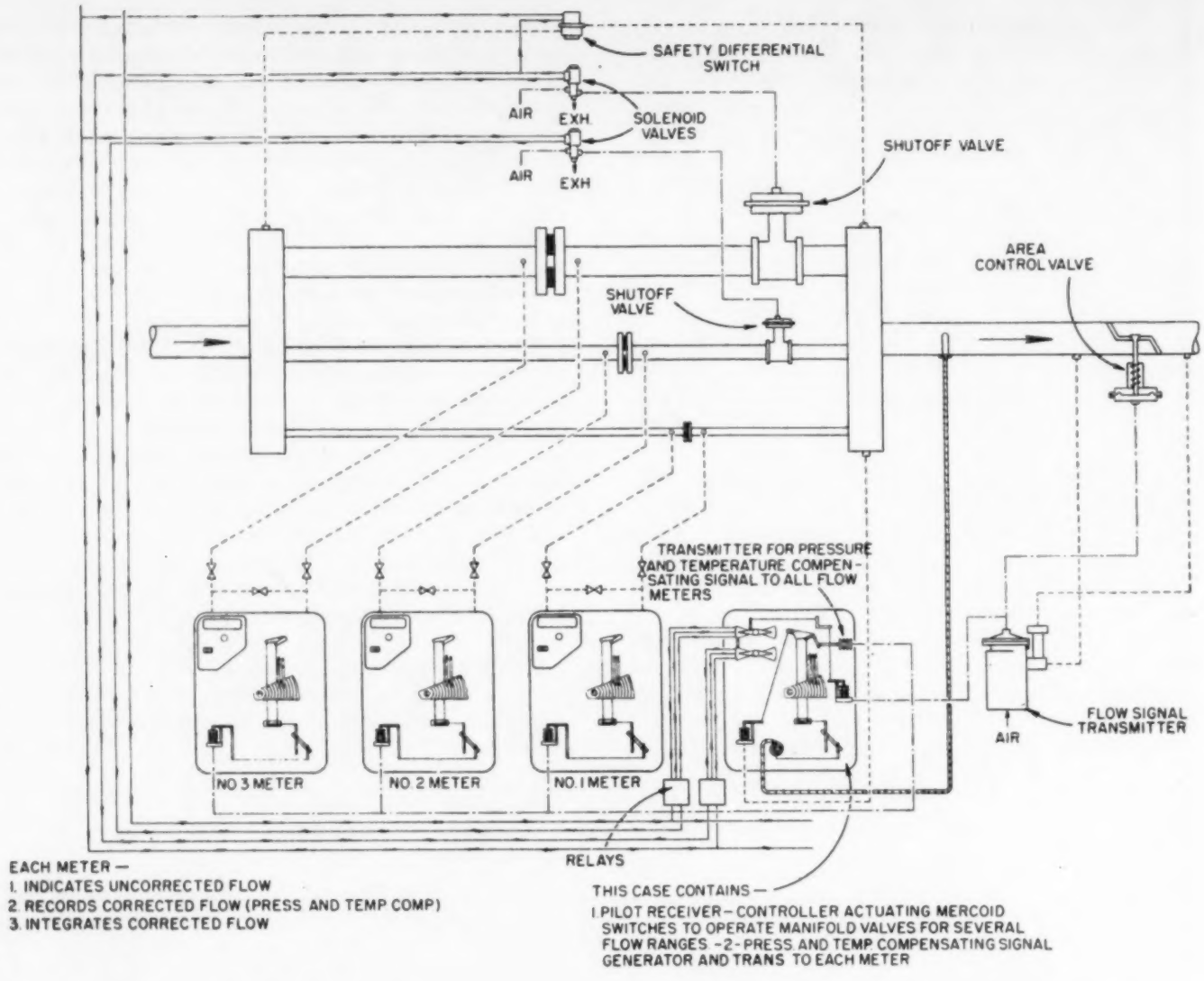

SAFETY DIFFERENTIAL SWITCH
AIR
EXH
SOLENOID VALVES
AIR
EXH
SHUTOFF VALVE
AREA CONTROL VALVE
SHUTOFF VALVE
TRANSMITTER FOR PRESSURE AND TEMPERATURE COMPENSATING SIGNAL TO ALL FLOW METERS
FLOW SIGNAL TRANSMITTER
AIR
NO 3 METER
NO 2 METER
NO 1 METER
RELAYS
EACH METER —
1. INDICATES UNCORRECTED FLOW
2. RECORDS CORRECTED FLOW (PRESS AND TEMP COMP)
3. INTEGRATES CORRECTED FLOW
THIS CASE CONTAINS —
1 PILOT RECEIVER – CONTROLLER ACTUATING MERCOID SWITCHES TO OPERATE MANIFOLD VALVES FOR SEVERAL FLOW RANGES -2- PRESS AND TEMP COMPENSATING SIGNAL GENERATOR AND TRANS TO EACH METER

Figure 9 — This system, in which a differential controller and valve are used, produces very smooth switching.

If flow increases beyond the capacity of the intermediate meter, the pilot meter sensing this same quantity of flow trips open the high flow metering line diaphragm valve. The high flow meter now picks up most of the load. However, since there is no stop valve in the bypass line, some oxygen will flow through it, and the flow in each line will be in proportion to its area.

In this system, both lines are open with flows over 25,000 cfhr. Therefore, the capacity of the system is the sum of the high and intermediate meters. Total gas flow is the sum of the three integrators.

Ordinary loads are usually measured with the bypass intermediate meter in service; and when one or more scarfing machines are operating, the high meter measures the flow. The metering in this system is done entirely by mechanical instruments with the electrical switching being simply a transfer job at terminal flows.

The fourth and last of the multiple metering systems is illustrated in Figure 9. It comprises a standard 3-pipe manifold with small, medium and large flow lines. Shut-off valves are located in the medium and large lines. There is no valve in the small line. Individual orifices are located in each line, sized to provide approximately the same drop for full flow on each of the three meters.

An area control valve is located downstream from the manifold and its pilot controller maintains a constant pressure drop of between 10 and 15 psi across the valve.

With low flows the control valve is very nearly closed, and all gas passes through the small line. As flow increases beyond the capacity of the small line and the low capacity meter, the pilot controller also senses this increase in flow and changes the signal pressure to the diaphragm control valve, opening it further so as to maintain the desired differential across the valve. This change in signal pressure to the valve is also felt by a pneumatic electric switch which opens the medium size line valve and brings on the second meter in the manifold. Both the small line and the medium size line split the flow between them in proportion to their areas. As flow increases farther, the pilot controller opens the control valve still farther; and if demand warrants, trips a second switch thus opening the large line valve and metering begins there. Now total flow is split three ways in proportion to line sizes. All three meters now read approximately the same percent of total chart.

In this system, the use of the differential controller and valve produce very smooth switching. As flow in-

creases and transition occurs and another line is brought on, the smaller line or lines remain in service passing the same amount of oxygen which a few seconds before represented the total flow. The opening of another line only adds capacity to the quantity flowing—it does not replace it.

Switching downwards on a decreasing flow is done in a similar manner and adjustable overlap can be introduced for best operation. This system does have the advantage of maximum smoothness of operation.

One component illustrated in this particular layout, but which can be installed in any of the systems described, is a switch actuated by differential pressure across the entire manifold. If for any reason, failure of fuses, loose connections or other reasons, the differential across the manifold exceeds the maximum differential of the highest range meter by a given amount (adjustable), the large line valve is automatically opened.

This type of manifold metering system incorporates another feature. That is, if expansion is contemplated, the system can be increased by adding another line and another meter very easily.

GENERAL

The question may be asked, "Why is a pilot meter used?" Why not a continuation of the two meter self-switching scheme? The answer is that the use of a pilot meter simplifies the switching or transfer problem. It is simple enough to transfer from one meter to the next in one direction, for example, on the way up—but to transfer in both directions, that is, both up and down, and also provide for adequate adjustable metering overlap or spread, is simplified with the use of a pilot meter. Since it is easy to synchronize ring balance flow meters, adjustment of the transfer switches is no problem.

An interesting sidelight on the value of multiple meters for measuring very low flows was experienced during the recent steel strike. The only flow through the multiple meter system in one particular plant consisted of line losses and a small spasmodic torch maintenance load.

Since the reducing valves used to bring the high pressure gas pressure down from tanks to plant line pressure were oversize for any infinitesimal flow such as this, the line pressure would decrease slightly and the reducing valves would lift off their seats for 2 or 3 minutes and then close off tight. The gas pressure would increase rapidly, filling the line, and then the pressure would gradually drift down until the valves would lift again and the process repeated. The multiple flow meter system, however, responded to the occasion. Since the plant is a big one and the lines are large and long, considerable capacity was involved, and to raise the pressure 1 or 2 psi meant the passage of a sizable quantity of oxygen, the flow of which was synchronized with the pressure pattern.

The interesting thing about this flow was the 24-hour integrated total. The daily total ran about 24,000 cu ft or an average of 1000 cfhr measured and integrated on a system whose capacity is 400,000 cfhr. This represents recording and integrating at 0.25 per cent of system capacity. This is another advantage of the multiple metering system. On holidays or other times when normal oxygen usage can be isolated or cut off completely, line losses can be definitely determined. If it is absolutely essential, for example, to measure a flow, say of 500 cfhr accurately as a minimum, and several hundred thousand cfhr as a maximum, then multiple meters are a must.

Ring balance meters are ideal for this type of load. Being mechanical meters, they are easily understood by steel plant instrument men. The testing, calibration, adjustment, etc., can be performed by regular instrument crews.

The instruments respond very rapidly to quickly changing flows and yet they are entirely stable. They are fully adjustable and each step in the metering process can be checked with ordinary tools and without taking the instrument out of the line.

There are many other less spectacular oxygen metering installations in steel plants such as those measuring flow to open hearths, air enrichment for combustion of fuels, scrap yard torches and lances, etc. The patterns are similar in a way—usually of the on and off variety—but the magnitude of the flow and time variations is nowhere near as great as in some of the cases described previously. Consumption of oxygen is growing and hence dependable measurement is important.

SUMMARY

1. A ring balance meter is a radial torque meter.
2. Mercury for sealing performs no function of the metering action, hence does not produce inertia.
3. Meters can provide results that are automatically corrected for pressure and temperature variations.
4. Metering of oxygen to automatic scarfing machines involves extremely high flow rates for short duration periods.
5. To measure the flow of oxygen to a single scarfing machine—a single meter is probably best for the job.
6. For distribution or cash register purposes where there is a variable and substantial base load in addition to one or more scarfing machines, multiple meters are usually necessary.
7. In multiple systems using ring balance meters measuring is done by mechanical instruments and switching is performed electrically while valves are operated by air. This combination provides a smoothly working team and produces dependable results.

DISCUSSION

PRESENTED BY

ROBERT FRANCY, Weirton Steel Co., Weirton, W. Va.

EDWARD E. CALLINAN, Engineer Combustion Refractories, Alan-Wood Steel Co., Conshohocken, Pa.

MARSHALL S. GARE, Hagan Corp., Pittsburgh, Pa.

Robert Francy: A few years ago, such an elaborate system of metering as described was not needed be-

cause each individual user of oxygen had his own cylinder bank and that was that. Soon centralized supply centers replaced the individual bank and still later a few steel plants owned their own oxygen plants. Right away somebody wants to know where the oxygen went. This "somebody" is usually the accounting department, because the operator of oxygen-using equipment is interested in only two things—lots of pressure and lots of oxygen. Along with the savings of centralization came the problems of metering.

At Weirton Steel we have an 18-ton oxygen plant which supplies the mills with gas for scarfing, scrap burning, and use in the open hearth for lancing and carbon reduction. We are metering all this oxygen with a ring balance meter which is compensated for pressure and temperature. Originally the meter had a fifteen second integrator on it; but one day our oxygen plant superintendent figured out that under certain circumstances an astonishing amount of oxygen could get past the integrator without being counted. As our plant load is not nearly as rough as some of the loads we have just looked at, we have installed a 7½ second integrator on this meter and feel we are covering the situation.

We have had this meter in service some four years and I must say that we have had little or no trouble with it. We liked this meter so well that when a new control job in our open hearth came up we put another ring balance meter on it.

Edward E. Callinan: I have two questions I would like to ask the author. First I would like to get some idea of the amount of error which might be introduced if pressure and temperature are not corrected, assuming a normal steel plant system where lines may go some length and be subjected to various conditions of exposure in regard to temperature and pressure.

The second question I would like to ask, too, is this. Given a system in a steel plant where there are four or five points of usage, is it better to put the meters close to the point of usage, or would it be better to have the meters back close to where the lines take off from the main line?

M. S. Gare: The answer to the first question depends on the amount of variation expected in the pressure and temperature readings. Since the correction factor for variation in pressure or temperature varies as the square root of the absolute pressure or temperature from the factor used in the base for which the meter was calculated, the error can be quickly determined.

Figure 5, a 24-hour chart shows that the oxygen pressure ahead of the reducing valve in the scarfer head was recorded, and the pressure at that point, I think, was 150 psi. Every time the scarfer operated, the flow pen rose from 0 up to approximately 70 per cent of chart. The pressure in this supply line dropped about 10 psi. If there is a substantial pressure drop at the point of metering, then we believe that pressure compensation is worthwhile. The correction might run as high as 5 or 6 per cent. Oxygen metering is done in the supply line at 150 psi and this pressure is reduced to about 40 psi by a reducing valve for operation in the scarfing head.

On service such as this, probably 75 per cent of our meters are pressure compensated, and of this 75 per cent, probably half of these are compensated for temperature also.

With respect to the second question, "Where should the meter be located?" it depends on the particular job. In this instance the instrument to measure oxygen to the scarfing machine was installed fairly close to the scarfer. As a matter of fact, in the same mill, several thousand feet away from the scarfing machine, another similar meter was installed to measure oxygen production. The scarfing meter has a capacity of 300,000 scfhr and the production meter, the capacity is 400,000 scfhr. The pattern on the production meter chart was very similar to that of the scarfing meter, with the exception that there was a base load measured on the production meter practically all of the time.

Obviously, the further away you are from an erratic load such as this one at the scarfer, the less violent the fluctuations are because of the volume of gas in a long length of pipe. This large volume acts as a cushion to the meter.

In general, if we can have a good metering run, it is possible to put the instrument either close to the consuming unit or some distance away, preferably at a distance.

Member: May I ask this speaker, you have two meters there, one that measures 25 per cent of oxygen; the other one bypasses 75 per cent, is that not right?

M. S. Gare: That was a particular system which you have described. These instruments can be assembled in a multiple metering system in whatever way is necessary to obtain the best results. If some natural minimum value is given such as, for example, a rate of 500 scfhr over a week-end or shutdown period, this rate then establishes the capacity of the smallest meter in the system. Likewise, the maximum value to be measured in the system has to be determined and the number of meters required to measure between these two extremes arranged to fit into the system.

There is a demand for copies of the following Yearly Proceedings:

1919 1937 1941
1942 1943 1944
1948

If your copies are not in use please get in touch with us.

ASSOCIATION OF IRON AND STEEL ENGINEERS, 1010 EMPIRE BLDG., PITTSBURGH 22, PA.

HIGH SPEED MILLS AND THEIR APPLICATION TO FERROUS AND NON-FERROUS ROLLING

By GEORGE PERRAULT, JR.
E. W. Bliss Co.
Salem, Ohio

. . . . the increased speeds which operators demand require refinements in all the essential mill components to insure economical and satisfactory mill operation . . . .

▲ ROLLING mill reference books, which catalog all types of mills according to size, speed, power, etc., indicate that the trend to faster mills did not develop to any popular proportions until about 1935. It was not until a combination of developments, such as metallurgical advancements, improvements in mechanical and electrical designs, crying needs for expedients of economy, and decision to take carefully calculated risks, that many refinements, including increased speeds, were incorporated into new mills. Then, still greater emphasis on speed was stressed later, when the exigency of World War II arose. This emphasis was not solely satisfied by actual direct mill speed-ups, but also by exacting simple, mechanized, efficient methods of handling materials, flowing to and from the mills.

In working out the best solution to the problem, management, operators, and mill builders, through their engineers, first studied the various means of obtaining maximum production out of any mill, then evaluated these means from the standpoint of justifiable investments and optimum advantage limitations to be reached, before hitting the "skids of diminishing returns."

Result is today that we have many mills which have been speeded up, either by improved material handling methods, or by actual speeding up of the mill and its auxiliaries, or both.

Among the mills now in actual operation, one of the fastest, is Jones & Laughlin's Aliquippa plant two-stand tandem tin temper mill for operation at a top speed of 6000 fpm. Another is their five-stand tandem mill capable of a top speed of 6000 fpm, for cold reduction work. Furthermore, it is not difficult to locate quite a few mills operating at 3700 fpm or more. Still more interesting is the recently publicized report of a new five-stand tandem mill about to go into operation, which is designed for 7000 fpm, or 80 mphr.

The most repeated question among engineers is: "Are such speeds practical and justified?" This can objectively be answered most reliably by examining the production and operating cost records; and, among high speed mills so far set into operation, the "young" records would indicate that high speeds are indeed justified, provided, other factors are considered.

It goes without saying that high speed mills, doing more work in a given unit of time, require more harnessed power, therefore, greater electrical equipment investment. Such an investment and the extra required mechanical investment for machining refinements, top quality bearings, dynamic balancing of rotating parts, etc., is sound provided other conditions are altered to keep pace, so to speak, and afford the combined maximum advantages.

First of all, where coils are involved, these must be enlarged by building up same through weld-splicing ordinary sized coils, towards realizing full use of the mill once fully accelerated in rolling. In other words, the ratio of coil handling time to contact (or rolling) time, must be reduced. Where other forms of materials are involved, such as straight bars or pieces, then,

and especially then, must material handling time be decreased to get optimum use out of mill.

In all classifications of rolling, however, where speed is stressed, the material handling must be modernized and designed for efficiency.

This stress in speeds naturally growing out of demands for greater output in this 100,000,000 tons per year schedule, or race, exacts many surprising demands from the modern day designer; surprising indeed, when we witness modern butt weld pipe mills geared to produce pipe in the smaller sizes at the rate of 1200 fpm, and better, whereas most of us have known this type of production as one limited to 650 fpm at best.

Our company has designed several new fast mills, including one of the fastest mills now in operation, and has collaborated with personnel of several plants towards modernizing and speeding up several existing mills of obsolete vintage. We have witnessed already, the successful operation of these units in their daily production, seeing how they exceed anything of the past.

Where unprecedented speeds were involved, either in new designs or revitalizing programs, the developments were not spontaneous, or impetuously decided. The progress was slow, methodical, and carefully planned and evaluated with the people whom we served.

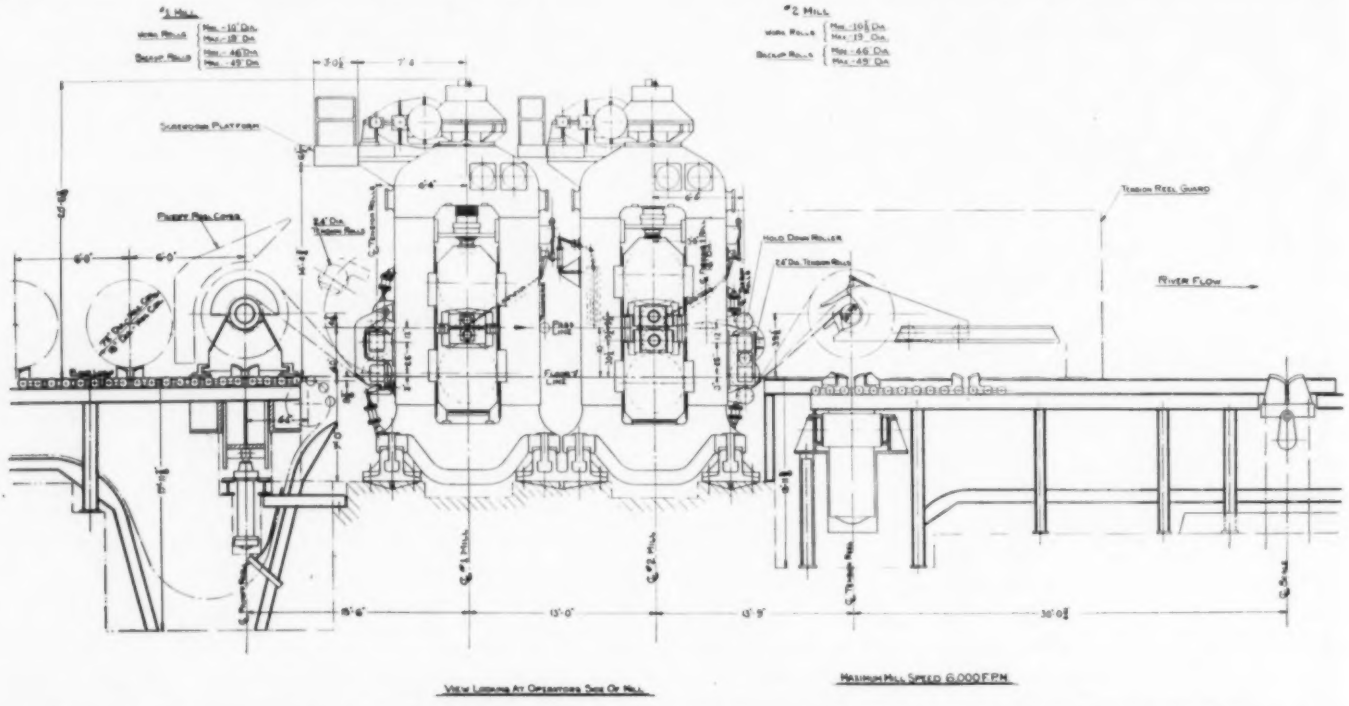


Figure 1 — Elevation shows arrangement of 2-stand tandem temper mill. This mill has a top speed of 6000 fpm.

High speed mills are not limited to ferrous rolling. The non-ferrous producers likewise have come to recognize the importance of speed; it is only fair to say that they recognized the merit of higher mill speeds long ago, but it was only after the chief problem of heat removal from the strip had been overcome, that they could make the jump into the speedier mill classification.

In the cold mill classification, the heat generated as incidental result of cold reducing has posed a serious problem in that whenever it could be removed through coolant media, the limitations were critically narrow, resulting in the necessity to keep speeds down, thus preventing heat or coolant oxide breakdown stains that marred the strip to make it commercially undesirable. Until recently, no corrective for this was available either; not even pickling would restore surface to desired sheen.

Today, however, we find several aluminum mills operating at 3000 fpm, and brass mills operating up to 1500 fpm, where the heat removal condition is most critical. This progress was made possible by recent metallurgical discoveries and developed practices, but most of all by improved coolant system designs and application.

Bad guesses cannot be tolerated. For the above reasons, the planning was deliberate and careful, naturally involving many conferences and time delays.

Among the first of our recent developments on high speed mills, is the two-stand tandem tin temper mill at Jones and Laughlin Steel Corp.'s Aliquippa works.

The progress in development of this 6000 fpm mill can be chronicled as follows.

Going back to 1949, or about two years before this mill rolled its first coil, Jones & Laughlin management and technicians, with their operating personnel, began their preliminary outside discussions with mill builders in order to outline that which they had in mind. These conferences had the usual exploratory results of confirming certain ideas, exploding others, and stimulating still better schemes by virtue of collective talent planning.

The mill was finally conceived substantially as indicated on our general arrangement drawing, shown as Figure 1, which gives an elevation. The mill auxiliary equipment, including conveyors, coil handling devices, air-coolant, hydraulic, lubrication, and safety systems, was equally emphasized in design and selection.

The No. 1 stand of the mill was designed with back-up roll drive on this nominal size 19 in. and 49 in. x 48

in. stand, thus affording use of a wide range of work roll diameters ranging from 10½ to 19 in., without "spilling out" of the motor speed range. Such an arrangement allows for considerable range of experimentation with various work rolls on the stand where, according to a favored theory, all the pass' necessary reduction will be taken to give desired temper, leaving the No. 2 stand to plannish and flatten the stock only. The No. 2 stand of the mill has a conventional work roll drive.

All the main mill drives are direct drives, each roll driven direct by its own motor. In this arrangement, each motor is complemented by a special thrust pedestal to protect it against thrust shocks, especially such as those possibly encountered in roll changing.

The No. 1 stand has each back-up roll driven by a 400-hp, 400/600 rpm motor. In this drive arrangement, a very unusual and ingenious motor elevator and position locking device was included to compensate for work roll diameter variations without spindle angularity, which could not be tolerated anyway. By this medium, the motors are elevated, or lowered, and locked into desired position, always making it possible to have horizontal and parallel spindle alignment, regardless of work roll size; within the range previously mentioned.

The No. 2 stand has each work roll driven by a double armature motor of 600 hp, 1150/1500 rpm. This affords a definite advantage in keeping down the Wr^2 inertia to be overcome in accelerating and decelerating.

The pay-off is a cone type unit powered from two 200-kw, 300/1500 rpm drag generators, and entry tension rolls are powered by a 300 hp, top roll motor only. Both units are designed for most rapid coil handling which is a must for optimum advantage even though coils may run as heavy as 50,000 pounds eventually. To facilitate threading, the entry tension bridle pivots 120 degrees about the top roll shaft, and is locked in that position for safety of operators during strip threading.

Delivery tension rolls are powered by a 600-hp, double armature, 850/1500 rpm motor on each roll, while the tension reel is powered by a 600 hp, double armature, 300/1500 rpm motor.

In addition, of general interest, are the elaborate lubrication, roll air-coolant, fog-exhaust, and hydraulic systems, plus the fine fire protection system for both Class B and C fires. The use of a fog-exhaust system on a dry mill of this type has as its primary function the elimination of fines of steel dust, etc., which occur when rolling at high speeds, in addition to the foreign matter entrained by the strip, which causes quite an air turbulence in the immediate surroundings.

Needless to say, because of high speeds involved, all rotating parts had to be dynamically balanced during manufacture, and special care exercised in coupling and spindle carrier designs.

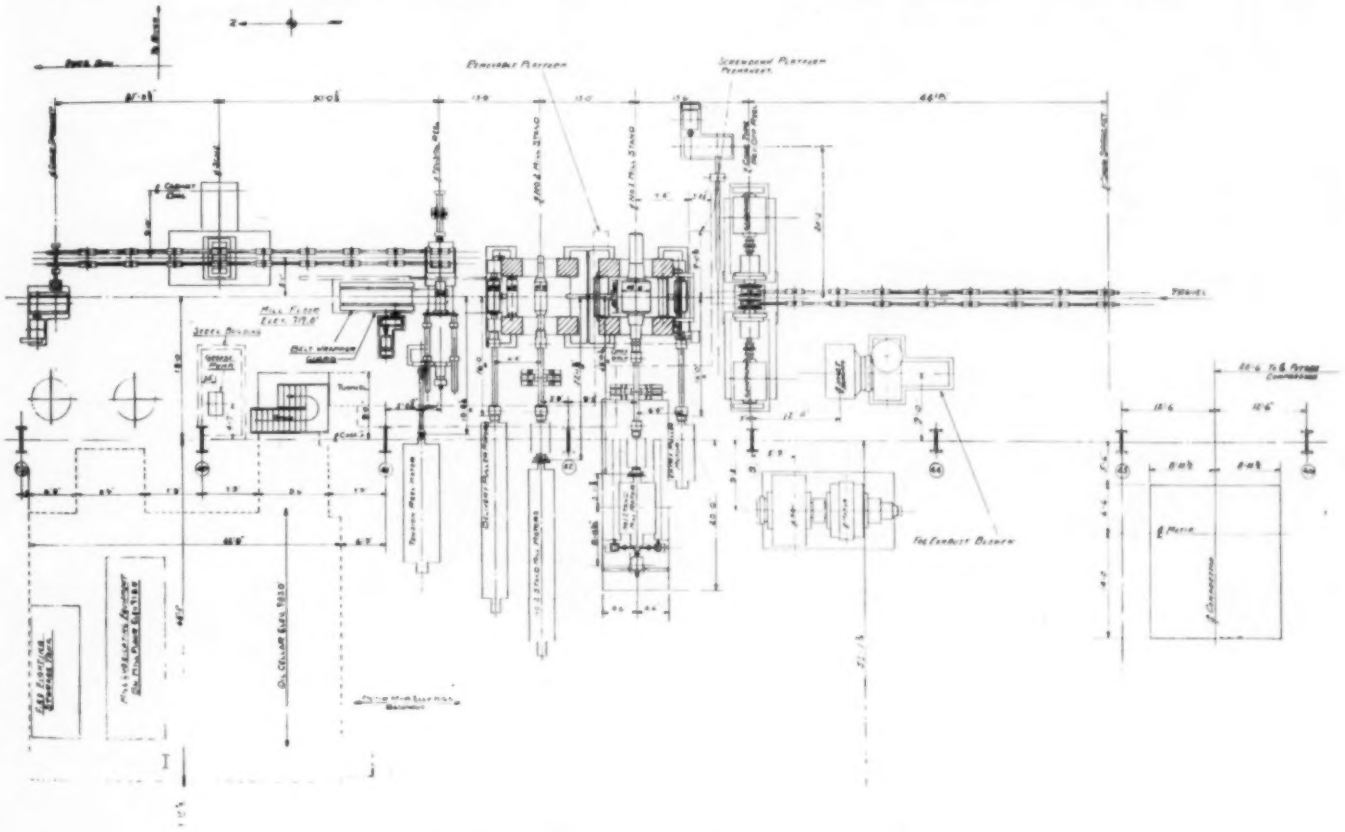


Figure 2 — Plan is for mill shown in Figure 1.

Figure 2 shows a plan arrangement of the same mill stand, giving a good picture of motor room and oil basement locations. All rolls on the mill stands are alloy forged steel. Figure 3 illustrates the actual installation.

The mill produced a commercially acceptable product on the very first coil rolled through the mill in October 1951. Thus far its achievement is reassuring and indicative in trend that the mill shall outstrip all averages of temper production records known, at the end of its first year of operation. Furthermore it will afford

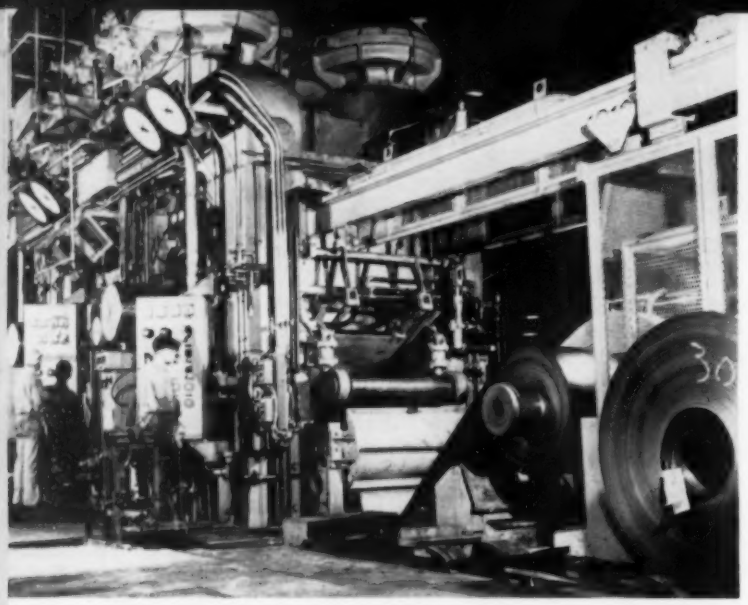


Figure 3 — This 2-stand temper mill is setting production records.

much experimenting around various rolling theories, to permit insight into actual power requirements, based on varying practices.

Another high speed mill of comparatively recent development was that applied to the cold rolling of aluminum foil. This unit is a cluster type mill as shown in Figure 4. This mill is equipped with forged steel rolls throughout and of size 10½ in. and 23½ in. x 60 in. for

mill applications, careful gearing selections were made on all reducers and pinion stand, placing particular emphasis upon fine teeth, or high diametral pitch selection.

The success of this mill is, however, mainly attributable to the elaborate coolant system and delicate arrangement of the entry and delivery tension devices, where driving powers have been carefully selected and distributed to allow a wide range of optimum tension values without risking web (stock) breakage or ruptures.

More recent designs, have wherever possible, eliminated gearing to minimize inertia drags which pose quite a control problem, when minimum tension values are dictated. One can imagine the need for a most delicate control, when dealing with a typical web of 0.00045 in. gauge by 52 or 30 in. widths; this condition is exacting. In mills of this type, including our own, the additional refinement of dancer rolls have been added to take care of primary pull-out torque while starting out a massive coil (of say, 5000 lb), on each pass, especially those of the final finishing, on very thin gauges.

Again a mill of this speed is justified where large coils, up to 5000 lb are available, and good coil handling system is incorporated to keep pace with the objectives, those of increasing production at reduced costs.

Roll coolant utilized and the design of the system employed, is, in this case, as in the case of the next mill

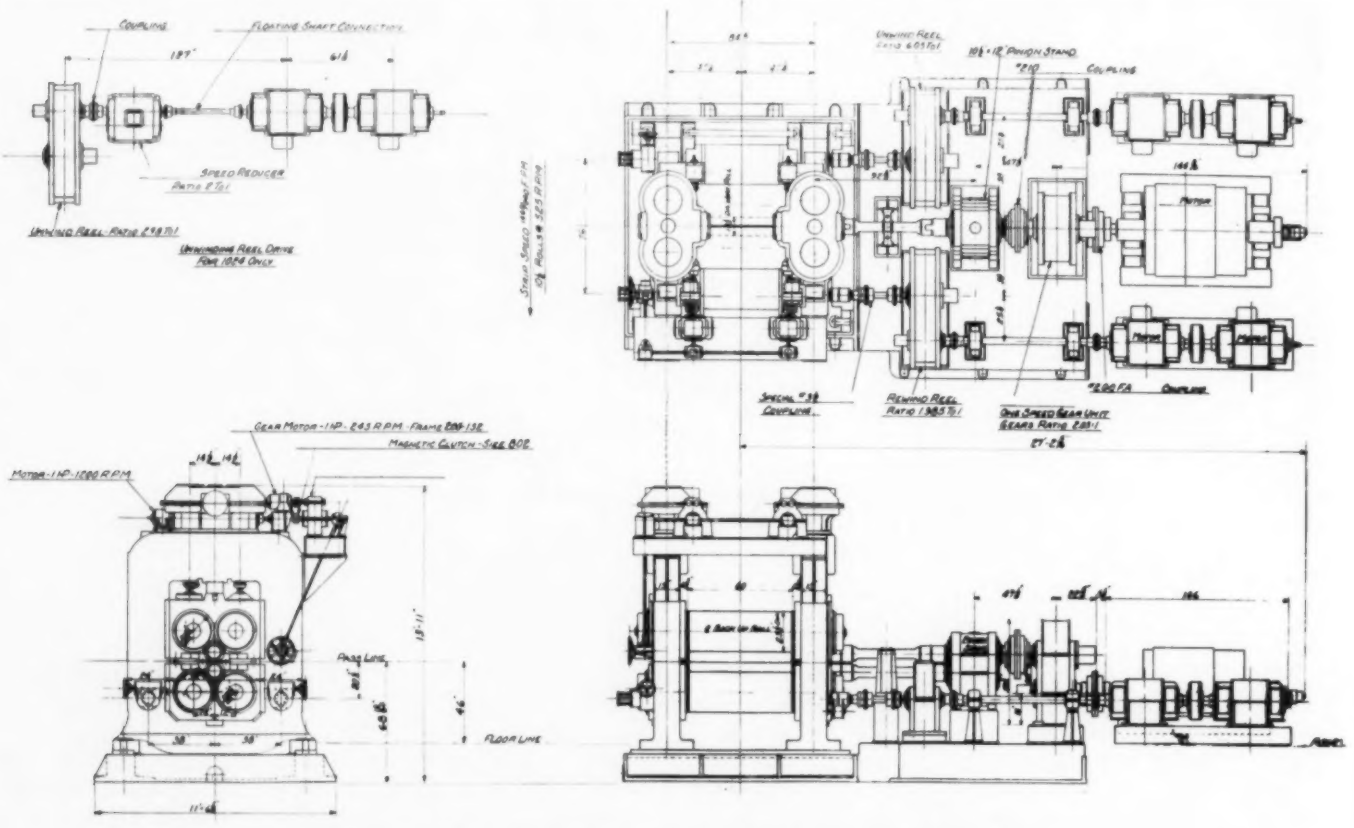


Figure 4 — This cluster mill is used for cold rolled aluminum foil.

rolling wide foil. The mill is equipped with a unique drive arrangement whereby its 650-hp motor may drive through a 2.03/1 ratio gear reduction unit or direct through a pinion stand, offering either 1480 fpm, or 3000 fpm top speed. In this design, like all other finish

to be discussed, very important because of the heat removal factor involved at high speeds. It is obvious that maintenance of uniform temperature and cleanliness of coolant medium is important. Medium is in this case, mineral oil, and so it is in most cases of foil roll-

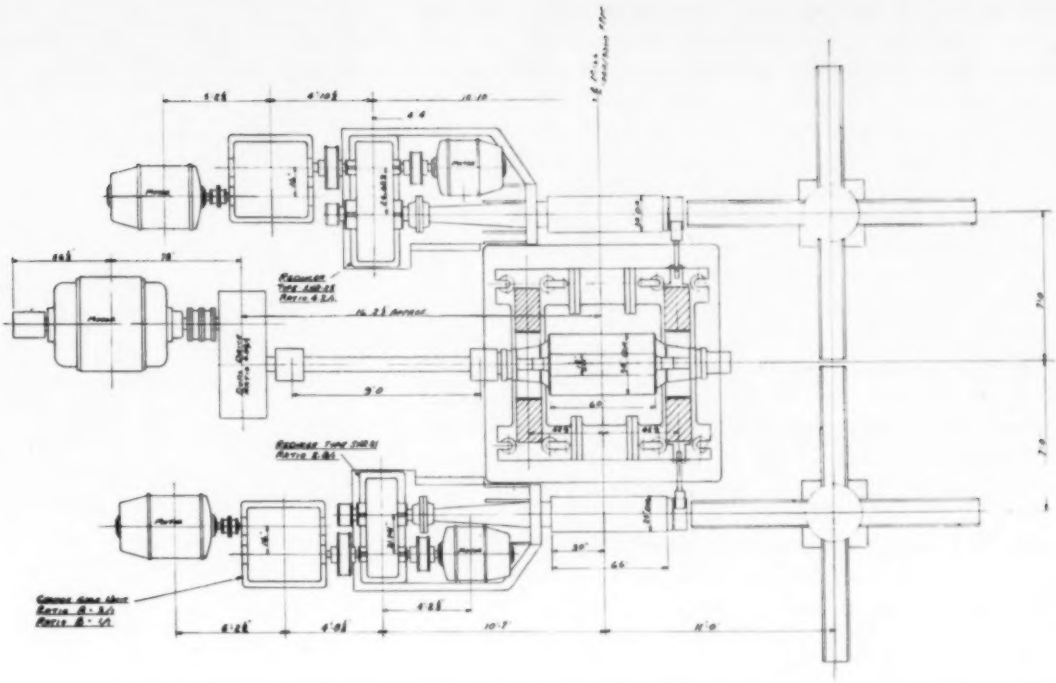


Figure 5 — Mill here shown is a 12-in. and 34-in. x 60-in. four-high aluminum foil mill. Top speed is 3750 fpm.

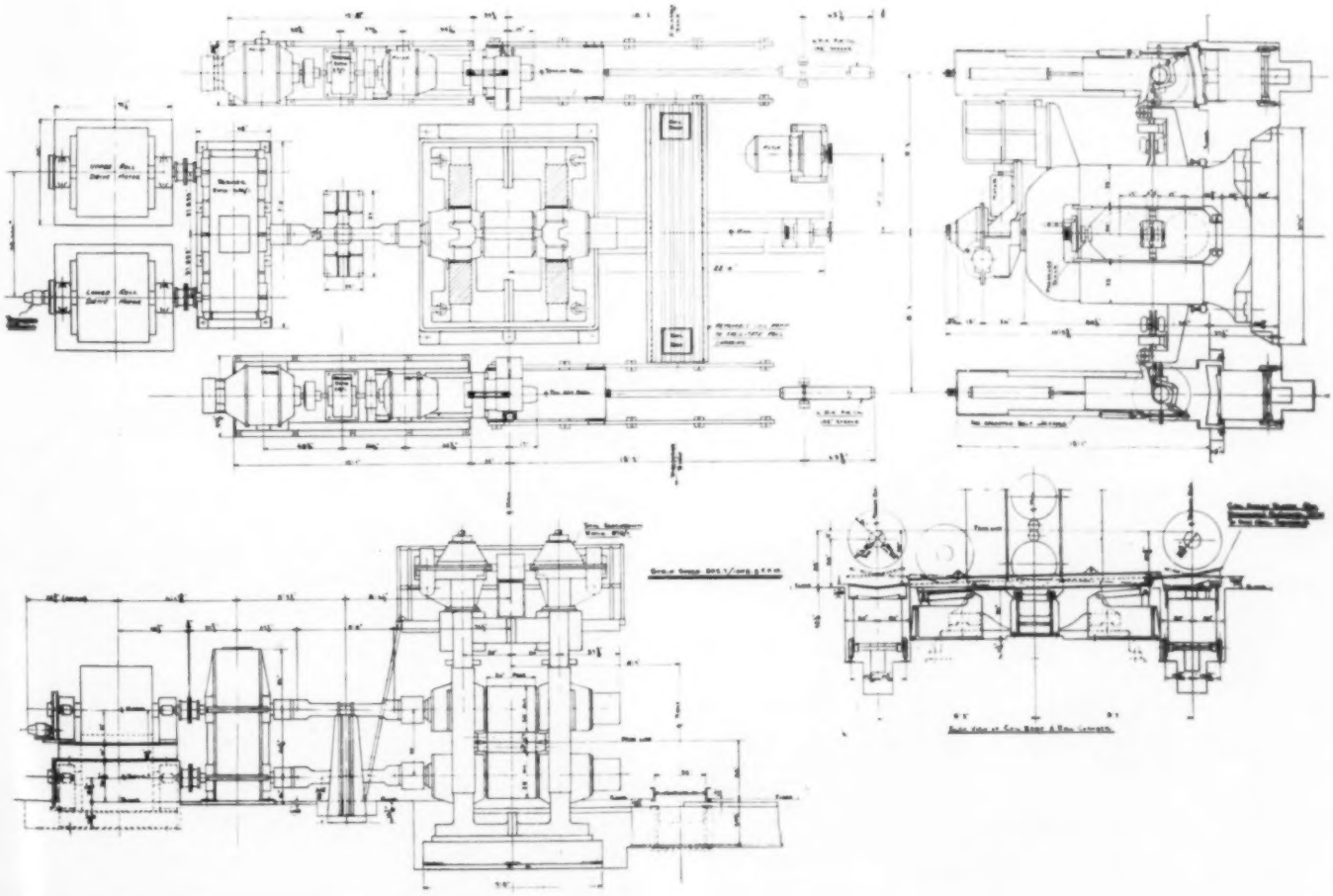
ing, although granted that several foil producers employ their own special, and often exclusive, preferences.

This particular mill has a 3 to 1 speed range, or 1000 to 3000 fpm on high speed connection, and 493 to 1480 fpm on low speed connection. Others are known to run as fast as 3750 fpm. For such a fast mill, Figure 5 shows typical arrangement.

The third case of high speed mills very much worthy of discussion today is a recent design developed with Revere Copper and Brass, Inc. for several of their plants. The mill in question is as shown in Figure 6, and involves a 6 in. and 28 in. x 30-in. four-high reversing mill.

This unit is unique in that it is a reversing mill and a

Figure 6 — Reversing mill shown is a high speed unit used in the brass industry.



high speed mill as brass mills go. Here again, is a case where management, engineering, and operations personnel of the user had faith in certain ideas as being progressive, and when studied in collaboration with mill builders, it was decidedly established that the element of risk was nil; on the contrary, the advantages to be gained in operating economy and improved product quality appeared as certain gains, when all angles of the project were critically analyzed. Resulting reality came to pass in the form of four such mills, the first of which went into operation September 2, 1952. Although it is yet too early to establish definite advantages, the trend thus far indicated is that the best expectations will be exceeded.

This mill is equipped with back-up roll drives also, with each roll independently driven through a gear reducer of the dual type, from a 300-hp, 450/900 rpm motor.

Tension values were carefully provided for by special plan on the distribution of powers, combinable or classification selected by means of special clutching devices. Each reel has a 75 and a 20-hp, 300/1200 rpm motor, with special strip alignment traverse on the entry side reel.

All rolls are equipped with anti-friction bearings, and of alloy forged steel.

For speeds involved in finish rolling of brass which is a delicate operation in itself, especially where finish gauges of 0.005 in. are concerned, special, careful selections had to be made, based upon the best available empirical data, where "tested theories" did not exist. These selections involved roll wipers, air wipers for strip, but especially the coolant system.

In this case, mineral oil coolant systems, complete with purifiers, clarifiers, heat exchangers and refrigerators were incorporated to insure maximum uniformity of the various properties of the coolant medium, and assure maximum economy of recovery and reconditioning. These refinements further permit experimenting with coolant temperature settings on the high or low side.

Moreover, special piping and spray nozzles were devised to provide uniform and/or selective spray conditions on all unit areas of the strip, lest heat stains develop. This part of the mill was also carefully equipped

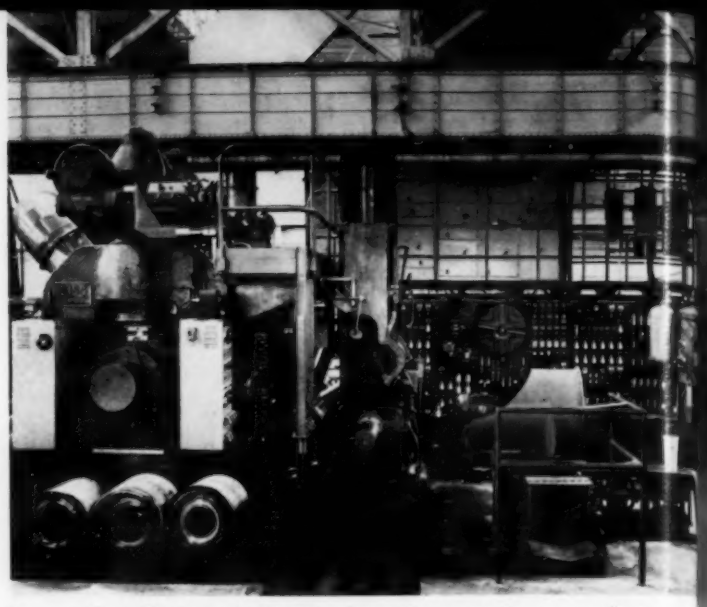


Figure 8 — Reel and electrical equipment for reversing brass mill are shown here.

with controls of various types to govern volume, pressure, distribution, and angle and type of spray pattern for the medium as flowed to the mill. Figure 7 shows the actual mill installation .

By virtue of its back-up roll drive, this mill again affords wide range of work roll diameter selections to suit various conditions already known as imperative. Speed of this mill is 1000 fpm maximum, but others have been in operation for speeds up to 1500 fpm. Here again, the coil handling equipment was designed with the stress upon efficiency and rapidity in coil loading and threading, towards setting up the logical complement of every high speed mill.

Speed is not the total answer or a panacea to all production ailments, but certainly not to be overlooked in any search for the best solution. In many cases, it may have merit, or even be the only solution to sluggish production.

One final point to be emphasized, however, is that neither we, nor anyone else, have yet figured out how to deny energy its full dues; at high or slow speeds, any given unit volume of metal displaced, regardless of process, takes so much horsepower to achieve, and whether done in one hour or one hundred hours, the

Figure 7 — This brass reversing mill is located at Rome, N. Y.

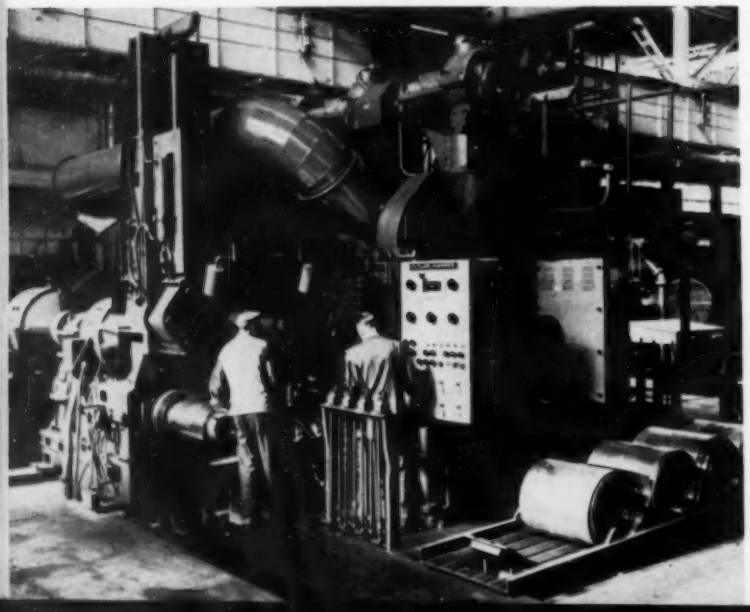
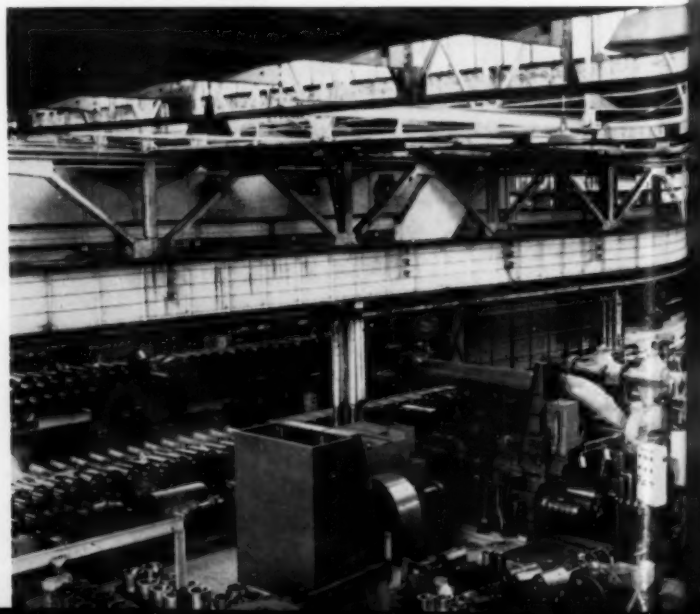


Figure 9 — This reversing brass mill also is equipped with back-up mill drives.



energy consumed is the same per ton of metal processed, so there is no use turning to speed to cut down kilowatt consumption per ton rolled on a given schedule.

DISCUSSION

PRESENTED BY

LOUIS MOSES, Rolling Mill Engineer, Bethlehem Steel Co., Bethlehem, Pa.

WILLIAM SMITH, General Foreman Electrical Tin Plate Division, Jones & Laughlin Steel Corp., Aliquippa, Pa.

G. E. FARRINGTON, Chief Engineer, E. W. Bliss Co., Salem, Ohio.

WILLIAM A. SPEARS, Chief Engineer, Dallas Division, Revere Copper & Brass, Inc., Chicago, Ill.

W. R. HARRIS, Manager Metal Working Section, Westinghouse Electric Corp., East Pittsburgh, Pa.

Louis Moses: Those untested theories which Mr. Perrault mentions loom prominently against the horizon of higher speeds. He presents the several factors from his experience in a most able and interesting manner.

Perhaps some of the present concern is completely unfounded, but one or two aspects might be worth mentioning. They poise the query on what will determine a maximum rate of speed in respect to the cold-rolled material itself, as well as toward providing a roll-metal to withstand the rigor of such speeds. Can they become so fast that insufficient time would be had to permit a proper arrangement of the granular structure or one that may be distinctly variable over the prevailing structures? Can speed acceleration create conditions which may or may not permit the roll-surface metal to accommodate itself to deformation to the same extent that it does at ordinary speeds?

Experience with hot rolling discloses a successfully working system of passes at an established speed not being at all satisfactory when run at a slower rate. Very considerable differences occur to the metal flow. Unfortunately, the effects are often merely noted with little or no investigation made on the underlying causes. Perhaps one day the laws of plastic deformation will be developed to a point of understanding and evaluation. However, in this example, we are dealing with material in the austenitic state which will cool to the same structure whatever the speed of working may be and assuming that the temperatures in either case have no great difference between them.

The significant question will concern the effects in the cold-reducing operation and whether some ultimate rate of speed will limit the rate in which the slippage planes of cold-worked steel can act without rupture? On the other hand, with later heat-treatment accorded after reaching gauge, it might well be that higher speeds will provide a better product.

Well recognized is the fact that the surfaces of a work-roll distorts from its ground circular shape. On the entry side of the roll gap the assumed shape, under pressure, is somewhat similar to that of an under-inflated automobile tire resting on a flat pavement. The balance of the gap becomes likened to a plane through which the material tends to skid. Whatever this shape may be, there is a decided distortion. The hard, abrasion resisting, roll metal must nevertheless be sufficiently ductile to withstand such change in shape, the cycles occurring an uncounted number of times at all and any given point around the circumference of a continuous direction mill. The condition becomes greatly augmented in a reversing mill where such stresses are being alternately reversed.

So we may ask ourselves, "What effects will increased speeds confer to the worked material as well as to the rolls?" We can be assured of one fact, the industry will continue to demand such speeds to obtain greater rates of production and lowered costs, and that they will be met by the plant and the roll metallurgist. Engineering materials, as well as knowledge, are advanced over those of only a comparatively few years ago, with answers to both questions forthcoming—particularly when such splendid studies as represented by this paper are being made.

William P. Smith: This paper has presented an excellent picture of the present status of high speed rolling mill development and illustrates clearly the great strides that have been made in recent years. Being an electrical engineer I cannot resist the temptation to claim a little credit, on behalf of electrical engineers, for these advancements. The improvement which has been made in control systems, regulating systems, electrical machinery and in the application of the theory of closed loop regulators has contributed substantially to the increased mill speeds that we have seen during the last 10 or 15 years.

As mentioned in the paper, mill speeds have increased to the point where many procedures formerly considered incidental to mill operation must be improved and streamlined in order to realize efficient mill utilization. Material handling has been mentioned as one very important problem and I think that several other aspects of the overall problem are worthy of mention.

Careful selection and training of operating personnel can make a very significant contribution to efficient mill operation. Men with good safety records, proven ability and that vital spark of team spirit can be formed into crack operating crews by good training programs.

In designing the mill and its electrical equipment, much thought should be given to features which will reduce threading time. The unique design of the entry puller on the Jones & Laughlin two stand temper mill mentioned in the paper is a good example. Other aids to threading can be incorporated in the electrical control, and such things as high speed screwdowns, belt wrappers and improved guides can all be used to advantage. The reduction of threading time is a very important factor, particularly when small coils are being rolled.

Good instrumentation will also help to raise the efficiency of mill operation by giving the operator the information he needs to "set up" the mill quickly and accurately. On the two stand temper mill at Jones &

Laughlin we have a continuous elongation gage, screw pressure indicators, an indicating and regulating tensiometer, and a selsyn system for screw position indication as well as a full complement of ammeters and speed indicators. Incidentally, complete instrumentation facilitates the collection of basic data for theoretical investigations and contributes generally to quality control.

Another factor which is very important in obtaining efficient operation from high speed mills is rapid acceleration and deceleration. This subject has been treated completely in several papers, but I would like to point out that it is a particularly tough problem on temper mills. Temper rolling does not require a large amount of power, and temper mill motors are therefore small in relation to the inertia of the mechanical parts they drive. Consequently high accelerating and decelerating rates are difficult if not impossible to attain. Fortunately temper mills do not tend to produce an unacceptable product so readily during acceleration and deceleration so that the lower rates generally can be tolerated.

Again with particular regard to temper mills, roll life can have a very direct bearing on mill efficiency. The product from a temper mill must, of necessity, be very flat and have an excellent surface. This means that the rolls must be maintained in first class condition at all times, and since the production of high temper product tends to deteriorate rolls rapidly, a large number of roll changes may have to be made. Unless every precaution is taken to facilitate roll changing and to minimize the number of roll changes, mill efficiency may suffer. On our two stand temper mill, the first stand is designed to accommodate a very large range of work roll sizes. This permits the use of small rolls for rolling high tempers and larger rolls for rolling low tempers. The former give shorter life but are often necessary for high temper products while the latter give long life and may be used for ordinary rolling. An overall reduction in number of roll changes can be realized as compared to the practice of using small rolls at all times.

To further aid in reducing roll changing time and to facilitate making screw adjustments while rolling, our mill is equipped with high speed variable screwdown drives. These drives utilize mill auxiliary type motors operated at twice normal voltage on the second speed control point with rotating regulators providing voltage regulation and current limit.

G. E. Farrington: Mr. Perrault has mentioned but three of the mills we have built in the last few years, with speeds above and beyond the accepted industry average. When we stop to consider that a crew of 8 or 10 men averaged one ton per 12-hour turn in the very early days of sheet production, we can realize the tremendous strides that have taken place. As you know, the first continuous hot strip mill was installed in 1926, which is only 26 years ago, and the first cold reduction tandem mill was installed three years later, or in 1929. Both of these mills had a top finishing speed of less than 1500 fpm and while the hot strip mill has only increased approximately 33⅓ per cent to about 2300 fpm, the cold reduction has almost been increased in speed to five times the original installation. As Mr. Perrault stated, a great deal of this increase in speed is due to larger and, therefore, longer slabs or coils. It is now not uncommon to roll full ingots to finish gauge whereas a number of years ago the slabs were sheared to sizes not exceeding 10,000 pounds. We know of one strip mill which is running coils as high as 26,000 pounds in widths of approximately 42 in. Cold mills are now handling coils weighing 76,000 pounds and, of course, are made up of several hot rolled coils welded together. This increase in coil weight and size presented new problems to operations and designers. A 76,000-lb coil approximates the weight of a railroad hopper car better than half loaded with coal or iron ore. To unload the material from the car, huge devices are used to rotate the car and when viewing their operation it appears that the equipment is traveling relatively fast. When one views the comparatively small coil of steel which is practicaly solid, it is easy to forget the concentrated weight incorporated in this object. These coils are handled at a much more rapid rate than the smaller coils originally used and with a greater degree of safety. Entirely new types of conveyors, coil buggies, tilters, payoff and delivery reels, were, of course, required for this heavier coil. The general trend, at present, is the modernization of existing equipment to handle coils up to a thousand pounds per inch of width, however, this does not necessarily mean that the maximum weight has been reached. The down time or handling time of the coil is amounting to a greater percentage of the total production time in spite of the fact that coil weights have been increased and the strip, therefore, made longer, and in spite of the advances made in handling the material. This is brought about by the more rapid increase in operating speeds of the mills and many operators feel today that the newly designed mills having speeds of 5-6000 fpm is the maximum which will be reached until better handling facilities are designed.

William Spears: High speed rolling mills are rather new to the brass and copper industry, as Mr. Perrault mentioned, and particularly a reversing mill of the type that he has shown. However, they come at a very opportune time in our industry because of the increasing trend toward lighter and lighter gauge metals. We are rolling brass now down regularly to 0.0045. We are getting inquiries for 0.0035 in. metal. We are going to be rolling more and more copper down to 0.002. We are not in the foil business yet, but it begins to look like it.

Most of this class of metal goes into automotive radiators, automotive heaters, etc. For a while steel radiators were being made, but from what I hear the trend is back to brass again.

A mill of this type, when you bring it into an industry that has had very little experience with high speed rolling, is interesting in the diversified fields that you get into. The rest of the industry has faced these problems and has overcome them with the cooperation of the manufacturers of auxiliary equipment. In the brass and copper field, these things are rather new to us, and I find it quite interesting to look at some of the problems that come up and the various fields that we are getting into that we never had to get into before.

One of the most fundamental problems, as you can realize, is getting a long bar. A reversing mill is not much use if your bar runs out in less time than it takes

to thread the mill, so we are very actively looking at various methods of joining coils together. That is good news for people that make welding, stitching equipment, or any other way you can conceive of for joining brass and copper. If anybody has any ideas, we would be only too glad to talk to them.

Another thing that high speed rolling has brought out is the need for better gauging of the metal. Contact gauging does not work when you get down to soft copper around 0.002, so we are now in the field of X-ray gauging, beta ray gauging, any other method for indicating the strip gauge at full speed.

Another field that we are into now that we never got into before is this matter of cooling, using mineral oil, soluble oil, or anything else that will work. That opens up a tremendous field in the brass and copper industry, a field for the suppliers of mineral oil and the suppliers of filters and heat exchangers, and all the other necessary equipment.

Our company is experimenting with about everything on the market dealing with coolant systems. We are trying continuous centrifuges, Fuller's Earth, purifiers, micronic filters. We are open to anything that will do the job.

We are also doing a great deal of experimenting with the heat problem in the coolant; that is, whether to cool the oil or whether to heat the oil. We are fortunate in having identical mills at several locations. One of our mills is actually putting heat into their coolant. They took their heat exchanger and piped steam into it instead of cold water. We are going to try to hold the temperature up to a predetermined point. Another mill has purchased refrigerating equipment. They are going to attempt to cool it down to a predetermined level. Each mill is running the same material at the same speeds. It will be interesting to see how it works out.

Also, it is quite interesting in the brass industry to watch the human relations problems develop as modern equipment is introduced. Brass mills by their nature are small; some of them are very small mills. The people have been there a great many years. Many of them have worked on only one type of mill. It is quite an experience to hear the observations and talk to these people, when they see some of this new equipment coming in. We are going to work hard and see that these mills go.

W. R. Harris: I would like to comment on certain of the electrical problems that arise on high speed mills. I would like to speak of two specifically: first—stored energy versus horsepower rating; and second—threading versus top speed.

It takes a certain amount of torque to make a specified reduction in a rolling mill and the horsepower depends entirely on the top speed of the mill. In other words, the horsepower applied to a mill varies directly as the speed. The stored energy, however, varies as the square of the mill speed and at the higher speeds, inertia problems increase accordingly.

For example, consider tandem cold reduction mills. The first such mills operated at around 400 fpm whereas some recent mills have top speeds of about 6000 fpm. The ratio of speed increase is 15 to 1 and the horsepower has increased by a factor of approximately 15. However, the stored energy in the mill parts has increased as the square of the speed and is 225 times as much. The relation of stored energy to horsepower is 15 to 1 which means that the mill is considerably more difficult to accelerate and decelerate. The solution of these problems has brought about many of the control and drive developments, such as the individual generator system, that have been made.

The second problem concerns the ratio of top operating speed to threading speed. Threading speeds have remained essentially the same as top operating speeds have increased. As these speed ratios have increased, the drive problems have increased accordingly due to the wide range over which successful operation must be obtained. Again, the solution of such problems has resulted in many control drive developments, such as rotating regulators and the newer magnetic amplifier regulators.

These problems, coupled with mill problems such as heat removal, strip and bearing lubrication, roll shape, and roll surface, make the modern high speed mill a triumph of engineering and operating achievement.

WANTED!

There is a constant demand for copies of "The Modern Strip Mill", published by the Association of Iron and Steel Engineers. If your copy is not in use please get in touch with us.

ASSOCIATION OF IRON AND STEEL ENGINEERS, 1010 EMPIRE BLDG., PITTSBURGH 22, PA.

Tentative Program

ASSOCIATION OF IRON AND STEEL ENGINEERS

1953 AISE CONVENTION

WILLIAM PENN HOTEL

PITTSBURGH, PENNSYLVANIA

September 28, 29, 30, October 1

Monday, September 28

9:00 am — REGISTRATION — Fort Duquesne Room

9:15 am — BUSINESS MEETING — Urban Room

Conducted by President John L. Young

9:30 am — OPERATING PRACTICE SESSION— Monongahela Room

"The Impact of Recent Technological Developments in the Light Flat Rolled Steel Process on the Automotive Industry and Can Manufacturing," by William T. Hogan, S.J., Professor of Economics, Fordham University, New York, N. Y.

"Scrap Preparation and Scrap Contamination," by Robert F. Kuhnlein, Superintendent of Construction, Sheffield Steel Corp., Kansas City, Mo.

"Modern Coal Mining—Underground," by R. H. Knapp, Chief Engineer—Coal, United States Steel Corp., Pittsburgh, Penna.

9:30 am — ELECTRICAL SESSION — Urban Room

"Grounded versus Ungrounded Low-Voltage A-C Systems," by H. B. Thacker, Distribution Engineer, Industry Engineering Dept., Westinghouse Electric Corp., East Pittsburgh, Penna.

"Cathodic Protection of Mill Grounding Systems," by J. F. Headlee, Electrical Design Engineer, Construction Engineering Bureau, United States Steel Corp., Fairless Hills, Penna.

"Integrated Electrical Equipment for Blast Furnaces," by C. P. Hamilton, Application Engineer, General Electric Co., Schenectady, N. Y.

2:00 pm — MECHANICAL SESSION — Monongahela Room

"Foundation Design for Iron and Steel Plants," by G. S. Richardson, Consulting Engineer, Pittsburgh, Penna.

"Water Supply for Steel Plants," by Ross Nebolsine, President, Hydrotechnic Corp., New York, N. Y.

"Ultrasonics in Maintenance Planning and Product Quality Control," by R. L. Rectenwald, President, Maintenance Engineering Corp., Pittsburgh, Penna.

2:00 pm — OPEN HEARTH SESSION — Urban Room

"Improved Cleaning Techniques for Open Hearth Checkers," by J. J. Enochs, Sales Engineer, Dowell, Inc., Wilmington, Del. and Reece Kincaid, Sales Engineer, Dowell, Inc., Chicago Heights, Ill.

"Cleaning of Open Hearth Checkers and Sewers During Operation," by Robert M. Jordan, Assistant Superintendent No. 3 Open Hearth, Bethlehem Steel Co., Lackawanna, N. Y.

"Republic's New Open Hearth Furnaces at Cleveland," by E. C. McDonald, Superintendent, Combustion Dept., Republic Steel Corp., Cleveland, Ohio.

"New Open Hearth Furnaces at Stelco," by E. T. W. Bailey, Chief Combustion Engineer, The Steel Co. of Canada, Ltd., Hamilton, Ontario, Canada.

9:30 pm — PRESIDENT'S RECEPTION AND INFORMAL DANCE — Urban Room

Tuesday, September 29

9:00 am — BLAST FURNACE REFRACTORIES SESSION — Urban Room

"Temperature Distribution in the Hearths of Blast Furnaces," by Professor V. Paschkis, Technical Director; and Taghi Mirsepassi, Research Engineer, Heat and Mass Flow Analyzer Laboratory, Columbia University, New York, N. Y.

"Trends in Blast Furnace Linings," by Hobart M. Kraner, Ceramic Engineer, Bethlehem Steel Co., Bethlehem, Penna.

"Bricklaying as a Factor in the Performance of Blast Furnace Linings," by W. S. Debenham, Research Associate, Research and Development, United States Steel Corp., Pittsburgh, Penna.

9:00 am — LUBRICATION SESSION — Monongahela Room

"Activated Alumina for the Maintenance of Gas Engine Crankcase Oils," by Lowrie B. Sargent, Jr., Assistant Chief, and E. M. Kipp, Chief, Lubricants Division, Aluminum Research Laboratories, Aluminum Co. of America, New Kensington, Penna.

"Oilless Bearings — Their Place in Industry," by Charles D. Spadone, Vice President, Spadone-Alfa Corp., New York, N. Y.

"Application of Bronze Bearing Alloys," by James L. Duchene, Sales Representative, National Bearing Division, American Brake Shoe Co., Pittsburgh, Penna.

"Laminated Fabric Bearing Materials," by Richard L. Berry, Manager, A-B-K Sales, American Brakeblok Division, American Brake Shoe Co., Detroit, Mich.

2:00 pm — MATERIALS HANDLING SESSION— Monongahela Room

"Imported Ore Handling — Machines and Practices," by Erle M. Hays, Sales Engineer, Crane & Bridge Dept., Engineering Works Division., Dravo Corp., Pittsburgh, Penna.

"Intra Plant Handling of Round Billets and Pipe with Special Automotive Equipment," by J. D. Tyson, Superintendent, Warehousing and Shipping Dept., National Tube Division, United States Steel Corp., Lorain, Ohio.

"New Developments in Mechanized Packaging of Sheet Products," by M. B. Hall, Chief Engineer, Development and Research Dept., Acme Steel Co., Chicago, Ill.

"Application of Self-Centering Rolls for Strip Processing Lines," by E. T. Lorig, Chief Development Engineer, United States Steel Corp., Pittsburgh, Penna.

2:00 pm — ELECTRICAL SESSION — Urban Room

"System Engineering for Continuous Strip Processing Line," by J. S. Apperson, Steel Mill Engineering, Industrial Engineering Section, General Electric Co., Schenectady, N. Y.

"Temper Mill Control," by George P. Dirth, Electrical Engineer, Granite City Steel Co., Granite City, Ill.

"Estimating Motor Room Installation Costs," by Wray Dudley, Chief Consulting Engineer, Patterson-Emerson-Comstock, Inc., Pittsburgh, Penna.

"Crane Power Limit Switches," by Robert W. Graham, Superintendent Electrical Dept., Bethlehem Steel Co., Lackawanna, N. Y.

6:00 pm — OLD TIMERS DINNER — Urban Room

Wednesday, September 30

9:00 am — OPERATING PRACTICE SESSION— Urban Room

"Growth Possibilities of Electric Furnace Carbon Steel," by W. C. Wheeler, Management Consultant, New York, N. Y.

"Cost Comparisons of the Open Hearth and Electric Furnace," by David D. Moore, Assistant Supervisor, Engineering Economics Division, Battele Memorial Institute, Columbus, Ohio.

"The Future of Large Electric Furnaces Compared to Modern Open Hearths," by Frank W. Brooke, Pittsburgh, Penna.

9:00 am — ROLLING MILL SESSION — Monongahela Room

"The Direct Rolling of Carbon Steel Ingots to Plates on Three High and Four High Plate Mills," by Robert C. McMichael, Supervisor 112-120-in. Mills, Lukens Steel Co., Coatesville, Penna.

"Recent Advancement in Continuous Butt Weld and Induction Weld Pipe Mills," by William Rodder, Vice President Charge Engineering, Aetna-Standard Engineering Co., Pittsburgh, Penna.

"Temperature Gradients and Stresses in Iron Work Rolls," by Charles F. Peck, Jr., Assistant Professor Civil Engineering, Carnegie Institute of Technology, Pittsburgh, Penna.

2:00 pm — COMBUSTION SESSION — Monongahela Room

" Progress in the Development and Application of Metallic Recuperators in the Steel Industry," by E. A. Vierow. Superintendent, Fuel and Power Dept., Youngstown Sheet & Tube Co., Youngstown, Ohio.

"New Soaking Pit Facilities at Ford Motor Co. Steel Division," by B. D. Barns, Supervisor, and H. E. Raaflaub, Senior Fuel & Utilities Engineer, Fuel & Utilities Dept., Steel Div., Ford Motor Co., Dearborn, Mich.

"Heat Processing in Industry — Facts and Figures," by Frederic O. Hess, President, Selas Corp. of America, Philadelphia, Penna.

2:00 pm — ELECTRICAL SESSION — Urban Room

"Modern Arc Furnace Equipment and Practices," by E. H. Browning, Steel Mill Engineer, Metal Working Section, Westinghouse Electric Corp., East Pittsburgh, Penna.

"The Determination of Optimum Current in an Arc Furnace," by W. E. Schwabe, Research Engineer, National Carbon Research Laboratories, Cleveland, Ohio.

"Problems in Supplying Power to Electric Furnaces," by George E. Duerr, Industrial Sales Manager, West Penn Power Co., Pittsburgh, Penna.

7:00 pm — FORMAL DINNER — Ball Room

9:30 pm — DANCE — Urban Room

Thursday, October 1

9:00 am — COMBUSTION SESSION — Urban Room

"Studies on Provision and Use of Oxygen in Steel Plants," by Glen O. Carter, Partner, Percival R. Moses & Associates, Consulting Engineers, New York, N. Y.

"Use of Plastic, Castable, and Gunning Materials in Soaking Pits," by W. D. Rees, Superintendent Bar and Blooming Mill, Sharon Steel Corp., Lowellville, Ohio.

"Combination Fuel Firing for High Pressure Boilers," by C. J. Webster, Fuel Engineer, National Tube Division, United States Steel Corp., McKeesport, Penna.

9:00 am — LUBRICATION SESSION — Monongahela Room

"Factors Affecting the Performance of High Temperature Greases," by Eldon L. Armstrong, Research Associate, Socony-Vacuum Laboratories, Technical Service Dept., Brooklyn, N. Y.

"Pumpability of Steel Mill Grease," by Joseph S. Aarons, Lubricants Chemist, National Tube Div., United States Steel Corp., Pittsburgh, Penna., Richard G. Warren, Lubrication Engineer, United States Steel Corp., Homestead, Penna., and J. J. Seaton, Laboratory Technician, National Tube Div., United States Steel Corp., Pittsburgh, Penna.

"Steel Mill Lubrication Problems," by A. C. Keiser, Jr., Supervising Lubrication Engineer, The Texas Co., Birmingham, Ala.; E. E. Perso, Supervising Lubrication Engineer, Los Angeles, Calif.; W. H. Mandy, Engineering Representative, The Texas Co., New York, N. Y.; and M. S. Clark, Chemist, Technical and Research Div., The Texas Co., New York, N. Y.

1:30 pm — INSPECTION TRIP TO PITTSBURGH WORKS, JONES & LAUGHLIN STEEL CORP.

THE PUMPING, TRANSMISSION AND BURNING OF TAR AND PITCH

By WARREN A. POND
Manager of Industrial Viscous Fluid Dept.
Fluid Systems, Inc.
New Haven, Conn.

. . . . for transmission of tar and pitch, a single line, heated system is recommended . . . .

▲ THE operation of blast and open hearth furnaces has for years kept the steel industry continuously confronted with the problems of disposal of coke by-products and selection of fuel for firing the open hearths. Independent decisions on these two questions have been practically ruled out because the economic factors are enmeshed. Some of these factors are prominent and are simple arithmetic; others are obscure and technical.

The primary objective of this paper is to present certain elements that bear on the selection of a pump for pushing tar and pitch; means for carrying the fuel from one point to another; together with comments on the choice of equipment for effective combustion. However, these selections and choices are secondary to the prior consideration of whether it is desirable to burn tar or pitch at all. Hence we first give brief review to the present position of the steel industry in relation to the production of tar. For this purpose, the position may be briefly summarized by two statements, neither of which is apt to be seriously disputed. The first of these is that coke is a unanimous choice of fuel for blast furnace operation, wherefore the industry must either purchase coke or produce its own. Secondly, the steel industry has no a priori reason for wanting to get into the tar products business. Indeed, the wish that tar production could be avoided altogether may be fervent in some quarters of the industry. Nevertheless, considerations of cost, quality, and continuity of coke supply, have led producers to operate their own coke ovens; wherefore they find themselves in the tar business whether they want to be or not. So a new situation is created, along with the need for another decision. What is the most economical method of tar disposal? The accounting procedure must be quite refined if a sound answer is to be had to the question "shall we burn all of our tar, some of it, or none of it?" Two companies possessing the same basic data can arrive at different decisions. Also, within the ranks of one management, opinion will change over the years. A company that once burned all of its tar may later have sold all of it and finally come around to selling part of it and burning the rest. Such experience does not indicate error in judgment. Rather it reflects the influence of invention and the everchanging market for tar and its deriva-

tives. An increase in demand for an established tar product, or the discovery of a use for a derivative heretofore deemed worthless, can affect the operation of an open hearth furnace.

Successive layers of vegetation laid under water any time between fifty and two hundred and fifty millions of years ago have become, under the influence of bacteria, pressure and temperature, our bituminous coal beds. It is a fortunate combination of circumstances that from this type of coal, a grade can be selected that not only cokes well, but also permits the most economical production of the best grade of tar. It is known that for good fusing properties and freedom from expansion while coking, coal should have a hydrogen-oxygen ratio of about 60 per cent. Lignites are too low in this ratio and anthracites too high. A good coking grade of coal, however, is bituminous, with a typical chemical composition of 85 per cent carbon, 5 per cent hydrogen, 9 per cent oxygen and 1 per cent other constituents. If coal with higher oxygen is used, the gas may be lower in both yield and heating value and the tar becomes poorer in quality, since the yield of valuable constituents such as naphthalene is reduced. One ton of coal may yield approximately 1200 lb of coke, 10,000 cu ft of gas, from 8 to 10 gal of tar and small amounts of other materials.

The question of what to do with the tar rests on three decisions. First, and from the viewpoint of the steelmaker exclusively, are tar and pitch desirable fuels for use in an open hearth furnace? Secondly, and this time from the point of view of engineering and maintenance, is the use of tar or pitch practical as a fuel? The third question and one that always interests everybody, is how the operating cost per million Btu liberated, compares with figures for other methods of firing. If tar and pitch are not suitable fuels, the problem is at once simplified, being reduced to a simple matter of selling it at the highest price, or burying it at the lowest cost.

Tar and pitch are desirable as open hearth fuels. Recent tests in which tar was burned in conjunction with coke oven gas indicate a substantial increase in furnace production. The reasons for this, if known, have not been reported but it is reasonable to believe that due to high free carbon content and low volatile, the flame emissivity may be higher than that obtainable with other fuels. Higher flame emissivity will certainly reduce the time required for heating up a charge or, if the furnace is continuous, will permit a higher rate of steel production.

Years of experience with tar as a fuel have provided answers to the question of practicability. This experience has been gained not only in steel plants, but also in city gas plants and in Pintsch gas plants. Tar can be successfully burned. Is it feasible however to burn pitch? Experience with this fuel is not very widespread but, such as it is, indicates clearly that pitch may be burned either as a liquid or a pulverized fuel. The determining factor is viscosity, or the extent to which the tar has been topped.

At this point, it is desirable to adopt some generally acceptable answer to the question, "what is pitch?" From the viewpoint of the chemist, pitch defies any attempt at definition, since it does not consist of any single molecular species nor any invariable combination of them. Neither does it have unique values of physical properties such as freezing point, boiling point, vapor pressure, specific heat or viscosity. We can, for example, say that pitch is an indeterminate mixture of many unsaturated hydrocarbons together with free carbon and it is black, highly viscous, and inflammable. The uselessness of such definition is apparent at once, since it fits tar as well or as poorly as it does pitch. It is better to be content with a description of pitch in terms of the measures employed for producing it. One can say that pitch is the residuum obtained from processing tar for the removal of various amounts of any low temperature distillates. Thus, if tar is topped by 10 per cent for removal of some xylenol, toluol, cresol, benzol, and phenol, the residue is very soft pitch. If 20 per cent is removed for recovery of larger amounts of these, plus most of the naphthalene and anthracine, the residue is still pitch. Finally, by increasing both temperature and time, pyridine, piroline and quinoline come off for a total removal of 50 per cent. The residue is hard pitch, and it is easily pulverized for blowing as a solid fuel.

Compared with tar, pitch has a higher pour-point. At any temperature, its viscosity is greater. The per cent of free carbon is higher. The calorific values of the two are substantially the same, being approximately 15,900 Btu per pound. Viscosities at various temperatures are as follows, if tar be compared with pitch left from a 20 per cent topping. At 120 F infinite viscosity is found for pitch and 1000 S.S.U. for tar. At 180 F the viscosities become 20,000 and 120 S.S.U. At 300 F they are approximately 200 and 36 S.S.U. From these data, it is evident that the use of pitch as a fuel is entirely practicable if suitable atomizing equipment is available. Indeed, if a tar system were operated at 160 F and a pitch system at 300 F, the viscosities would be identical at 200 S.S.U. The two systems would be mechanically similar in many respects. Pumps would be of the same type and size. The pipe lines would be identical, except that the pitch line might carry thicker insulation and would require more heat input for maintenance of constant temperature. The burner equipments might be quite different, but this will be considered later. The two systems would also have in common, the need for two precautionary measures. First, the use of any rubber or synthetic rubber should be avoided where possible, since none of these materials are passive in the presence of unsaturated hydrocarbons such as the creosote and anthracine oils, or the light oils—napths, toluol and benzol. The second is that the use of brass should be avoided particularly in the burner, since at elevated temperature it is rapidly attacked by cresylic and carbolic acids.

It is not within the scope of this paper to determine the cost per million Btu for any particular system. Your attention is invited, however, to some of the factors that must receive careful attention if such an accounting is to deserve a status better than that of an educated guess. Assume that the decision to burn pitch has been made. Such an assumption is reasonable, since today's market in respect to tar derivatives is such that it is doubtful if any tar producer can afford

to burn tar, as tar. The demand for naphthalene, as an illustration, has increased greatly in recent years. It is needed for dyes, medicinals, and organic intermediates such as phthalic anhydride, from which the glyptols are produced. The vital importance of phenol in the production of bakelite and other resins is recognized, as is the need for toluol in the production of explosives and solvents. The values of these materials in chemical industries is too high today to permit burning them anywhere.

One is left with the question, how large should the topping be? Twenty per cent or more would appear to be advantageous to both the producer of tar and those who will remove and market the topping. Obviously, however, they are the only ones qualified to render a decision. The question is brought up here for the sole purpose of pointing out that since the market at any time determines the most economical topping at that time, and since the per cent of topping fixes the temperature-viscosity property of the pitch, therefore any pitch system for serving open hearth furnaces must be designed for operation over a wide range of temperature. With periodic change in the market for tar derivatives, a pitch system designed for certain viscosity should utilize equipment that will provide continuously adjustable, automatic control of temperature at the pump and throughout the transmission line. If a transmission system is designed for 500 S.S.U., it should be instantly adjustable for any operating temperature between 135 and 265 F. If pump, motor, and piping have been selected on the basis of 100 S.S.U. then the range of operating temperature should be 185-340 F. In this way, any grade of pitch, from tar to material that has been topped by 20 per cent, can be accommodated on short notice.

A second factor, of importance in its bearing on the operating cost of pitch firing, is the selection of the most practicable layout for accomplishing it. It is one thing to agree on the general feasibility of burning pitch in an open hearth. It is another thing altogether to decide on what is the most feasible way of doing it. If items of equipment are to be selected with the object of attaining minimum operating cost, then careful examination must be made of the factors that bear on the choice of pump; the sizing of pipe and insulation; the means for maintaining constant temperature in the line; and the design of the burner. The most economical system is not apt to comprise the most economical pump, the lowest cost transmission line, and the cheapest burner. Such a situation is too simple. It practically never happens.

Before any attempt is made to select the pump, to size the pipe, and to choose a burner, a viscosity must be assumed. Then, if this assumption is grounded on familiarity with the problem, the system can be designed and installed. It will be a good system and will work. The chance is slim, however, that it will operate at the lowest possible cost. If operating cost is to be minimized and if the system is to possess that degree of flexibility that will assure constancy in operation, it should be laid out on the basis of two other viscosity levels—one above, the other below the value used first. When these three systems have been costed out, the way to minimum operating cost will become apparent.

The pump and transmission line are only a means toward an end. That end is, of course, efficient and reliable combustion. Therefore, let us first consider the question of the choice of burner. After a burner selection is made, the several combinations of pump and transmission line capable of serving the burner equally well will be examined; this with the object of obtaining that combination which will show the lowest total of fixed and operating charges, plus certainty of operation.

In the case of firing pitch in an open hearth furnace, it is probably necessary to weigh very heavily, the requirement that the risk of freezing up shall be low. Hence, a temperature at the fuel nozzle may be specified as high as 400 F. This would reduce the viscosity to approximately 50 S.S.U. Such a temperature probably precludes the use of any mechanical burner, because of the certainty of bearing difficulties. The choice of burner is thus narrowed immediately to the selection of a steam atomizer. If a steam supply is available, no objection will be raised to this choice. Such burners operate very well. There is a slight increase in flame length, to be sure, but this is easily accommodated in the combustion chamber of an open hearth. When well designed, such burners will operate on steam rates as low as 0.1 lb of steam per lb of fuel. An important requirement is the regulation of steam pressure so that it will at all times be slightly higher than the fuel pressure.

It is worth bearing in mind that future developments may point the way to burning liquid fuels having high viscosity at the burner nozzle. This would permit lower temperatures, reduced cost of heating, and permit the use of mechanical burners. We have heard of recent experiments in which the smallest particle size yet achieved in a fuel mist was produced. We believe that this has been accomplished with No. 6 oil at room temperature, utilizing a target type of atomizer and fuel pressures up to 600 psi. This arrangement has probably permitted the most effective use of a cross current air blast with resulting turbulence, minimum flame length and maximum emissivity.

Having decided on the burner, the next question to be faced is whether the fuel will be pumped and conveyed at the burning temperature, at the lowest pumpability temperature, or at some temperature between. Almost certainly it will not be pumped and conveyed at burning temperature. Long experience with heavy fuel oil has proven the advantage of producing the burning temperature at the burner. Therefore some sort of spot heater should be installed as closely as possible to the burner for that purpose.

So we come to that very important problem, the design of a pipe system for the most effective and economical transmission of pitch. This must precede pump selection, since pump size and horsepower are dependent upon line pressure drop and this must remain unknown until the most favorable pipe size has been established. This can only be accomplished by trial and the procedure is well known. Suffice it to say that a temperature well above minimum pump requirements may be tentatively selected. Then the viscosity is low, high Reynold's numbers with turbulent flow can be allowed, and the pipe held to small size. However, insulation will be thick and heating cost high because of

the temperature elevation required for the low viscosity. If the temperature be set at the pumpability minimum, then the viscosity may be high enough to require low Reynold's numbers and viscous or laminar flow. In this case pipe size will be large to avoid excessive pump horsepower, insulation will be thin, but large in diameter. The only saving is from a reduction in the heat loss in transmission and this saving is sometimes more than offset by sizing pipe to accommodate full circulating flow rate, instead of use-rate only.

The size of pipe is certainly not the most important specification for a good transmission system. It is secondary to other considerations. The heat loss should be a minimum consistent with cost of insulation. The system should be single pipe and not looped. It should permit the use of insulation that is minimum in amount, simplest in shape, and lowest in cost of installation. Furthermore, and of great importance in any system that is "on-off" in operation or that must be capable of periodic or complete shutdown, temperature drops and rises like those that are to be expected at fittings such as valves and flanged unions must be minimized. The heat input to the line should be accomplished in such a manner that control of temperature over any length of line within plus or minus 5 F can be assured. The cost of maintenance should be low.

Steam tracer systems persist in use for transmission of heated fluids. This use is falling off, however, since a steam tracer cannot possibly meet the foregoing specifications. Tracing permits temperature gradients around and along the pipe, so severe that continuous circulation is necessary. Hence, a simple pipe system cannot be used and the costs of pipe, insulation and maintenance are immediately doubled. Operating costs are frequently more than double. Furthermore, since the tracer is only in line contact with the fuel pipe, if it is in contact at all, the surface coefficient of heat transfer is low. Following a shutdown, heating up takes a very long time if it can be accomplished at all, and it is almost necessary to blow out the entire system with steam or solvent immediately following shutdown. The low heat transfer coefficient also makes it necessary to operate the tracer line at a temperature well above that of the fuel line. Therefore in order to hold the heat loss to a reasonable level, insulation must be designed for the higher temperature. Again, due to the irregularity of the overall configuration of pipe with tracer, the insulation must generally be of odd shape, which increases the costs of material, installation, maintenance and heat loss above that of preformed insulation. Incompatible temperatures also frequently affect the fuel, resulting in sludging or coking within the pipe.

All of these difficulties and disadvantages can be eliminated by utilizing the peculiar characteristics of steel or iron by using the fluid pipe also as an electrical conductor putting the pipe system in an electrical circuit to generate heat in the pipe wall itself.

This method of heating is completely effective and economical, having been well proven by extensive use. It should be noted that heat generation is not according to the simple I^2R formula and should not be attempted without extensive test data defining the combined effect of resistance, hysteresis and eddy currents. With such data available, however, exactly predictable amounts of heat can be impressed equally over every square inch of heat loss surface, at selective heat densities. A viscous fluid transmission pipe system so designed, will fulfill all of the listed specifications for this portion of the total fuel system. Furthermore, since heat is generated throughout the pipe, circumferential temperature gradients become zero and longitudinal gradients are reduced almost to zero. Hence a single pipe system is wholly feasible and it will never require blowing out in preparation for shutdown or flow standby. However, if extended shutdown is necessary, it can be accomplished at zero cost for maintenance or operation and heating up to flow temperature is assured. The time required can be held within close limits. Of interest here is the fact that uniformity of heat generation in Btu per sq in. of pipe surface, permits flow to be initiated long before the pipe contents have been heated to complete liquidity. The heated pipe wall will melt a tube of pitch with which it is in contact and within which most of the work is done against the shearing resistance of laminar flow. Flow then begins, with little rise beyond normal pump horsepower, even though the pitch in the center of the pipe may be barely soft.

Little need be said regarding the selection of a pump. This type of service requires a positive displacement pump. They operate over a wide range of viscosities. In making selection from the several types that are available, the factor of abrasive wear should be kept in mind. The carbon suspended in pitch is spoken of as "hard carbon" and it is capable of high rates of wear in some gear pumps. The single screw pump is meeting with increasing favor for moving fluids that carry abrasive materials.

Where the discharge characteristics of the centrifugal pump fit job requirements, such a pump will usually be preferred. It is relatively free of maintenance difficulties, is very efficient at viscosities under 1000 S.S.U. and is low in cost. A precaution to take in making a selection is to compare the designs in respect to those dimensions that affect the disc loss and the ring loss. These two losses can exceed the "through loss" at moderate viscosities unless the pump has been designed with the objective of keeping them low.

In recapitulation, the following facts and opinions may be listed. Some of these views are today accorded wide acceptance while others may still be debated in some quarters. The use of pitch as an open hearth fuel is practicable and compared with tar is desirable from the viewpoint of both the steel industry and the chemical industry. A factor that has important bearing on the economy of operation is the viscosity level, and therefore the temperature, at which it is decided to pump and transmit the fuel. Of even greater importance is the need for a piping layout that will show a minimum in length of pipe and number of joints, in cost of insulation, in heat loss, in temperature change and in cost of maintenance. It should guarantee a maximum in flexibility and reliability. A system that will fulfill these requirements at the lowest level of operating cost, is a single pipe layout and heating means that inherently assure absolute uniformity in the rate of heat generation over the entire circumference and length of the pipe from storage to burner.

DISCUSSION

PRESENTED BY

H. C. WHISTON, General Supervisor Power and Fuel, United States Steel Corp., Clairton, Pa.

WARREN A. POND, Manager of Industrial Viscous Fluid Dept., Fluid Systems, Inc., New Haven, Conn.

GEORGE H. KRAPF, Assistant Chairman Fuel and Power Committee, United States Steel Corp., Pittsburgh, Pa.

R. A. LAMBERT, Superintendent Steam and Combustion, Jones & Laughlin Steel Corp., Pittsburgh, Pa.

H. C. Whiston: Mr. Pond's paper is interesting to all involved in the production of coke and in the handling of the numerous by-products. The many new and controversial ideas covered provide ideal subject matter for discussion. The wish, in some quarters of the steel industry, that tar production could be avoided altogether was true in the past. At present, however, since the use and demand for aromatic chemicals is growing fast, the investment in a tar processing plant in connection with a large by-product coke works can be justified.

At Clairton Works we product about 300,000 gallons of tar per day at a rate of about 10 gallons per ton of coal charged. This tar is topped for an average removal of about 40 per cent. The remaining 60 per cent, or the pitch, pumped at about 650 F, is blended with virgin tar or fuel oil to a viscosity of about 500 S.S.U. at 200 F for open hearth fuel in our Pittsburgh district plants. In the open hearth shops the mixture is pumped at about 200 F and burned at about 250 F maximum.

All open hearth production records in Clairton Steel works have been broken by firing about 30 per cent tar-pitch with 70 per cent coke oven gas. This statement probably holds true in a great many other shops throughout the country. Prior to the recent steel strike, our three-inch distribution system in the shop was cleaned by pumping 5,000 gallons of creosote oil through the loop and then purged empty with steam.

The steam rate to the atomizer of about 1 pound per gallon estimated by Mr. Pond is considered low. We normally would expect a rate of 2 to 4 pounds.

The development mentioned of burning high viscosity fuel at the burner would reduce heating costs, but pumping costs at pressures up to 600 psi would increase considerably. This raises the question of metering. In our experience it is difficult if not impossible to obtain accurate metering at viscosities above 400 S.S.U. Spot heaters at each furnace should have accurate temperature or viscosity control for best results in metering and burning. Viscosity control has been tried at one of our district shops burning fuel oil with only fair success.

In our tar plant at Clairton, long experience has developed the pump design now used for large quantities. It is the steam duplex type with single ball valves, hard ringless pistons and stainless steel liners in the liquid end. This type pump provides ease of control, some measure of the product pumped and low maintenance costs.

In the open hearth shops we have more or less standardized on triplex pumps for large quantities of liquid fuel and steam duplex for small consumers. Our experience with screw type pumps in tar-pitch systems has been unsatisfactory. Small amounts of hard carbon suspended in the liquid cause increased clearance resulting in loss of head.

One of the few installations burning liquid pitch as an open hearth fuel is in the Bethlehem plant at Johnstown, Pa. This operation was covered in detail in a paper by J. F. Wilbur and published in the 1944 Proceedings of the Association of Iron and Steel Engineers. The pitch is pumped and atomized at about 300 F and the distribution loop consists of 3,500 ft of 4-in. and 3-in. line with a 1-in. tracer. The author stated that when the pitch supply to the furnaces is stopped, the lines are immediately purged empty with steam.

The steel industry, in my opinion, could not at present subscribe to changing from the loop distribution system to the single pipe system. This brings us to the interesting development of electrical heating to replace the standard steam tracer method. I think that the prejudice against single line systems is possibly due to the suspended carbon, or we call it coke, in a single pipe system. If the end furnace, or the two end furnaces are off, for complete rebuild, segregation will take place, and suspended carbon or coke will gradually build up at the end of the single pipe system. When the end furnace is fired, I believe trouble will develop with suspended coke. We would like to hear more about the details of such a system now in operation.

We would also like Mr. Pond to furnish rough figures covering power requirements, voltage to be used, and comparative installation costs for a 4-inch distribution system about 2,000 feet long. There are several in the country 4,000 feet long, but I am taking a bare minimum of 2,000; in fact, Clairton is about 2,000 feet.

Warren A. Pond: In answer to Mr. Whiston about suspended solids, I might mention that this subject has been discussed with a number of people in the industry. By making a few simple calculations which compare the quantity of sediment collected in a pitch storage tank over a year's time, with the volume of fluid which was stored during the same period, it was found that sediment resulting from the small volume of pitch contained in a pipeline would be insignificant. It was also felt that such small deposits which might be present would be re-entrained in the fluid when flow was again established.

In relation to the question about operating costs, it should be understood that only radiation losses are replaced by the electric method of heating. No attempt is made to heat the fluid during flow conditions. Actually, it is usually physically impossible to raise fluid temperature during flow because of the small surfaces involved, relatively negligible temperature differences and low watt inputs. It can therefore, be seen that operating costs are in direct relation to heat losses from the pipeline.

Generally speaking the electric method of heating under discussion, is not comparable to a simple uncontrolled steam trace system which follows a single line

discharge. When traced loops are employed, as is common in the industry, the electric method is definitely attractive from a cost standpoint. Consider that three-fourths of the pipe usually used in a traced loop can be eliminated.

I cannot give the cost of a 2000 foot piping system off hand. There are many things involved that make it difficult and affect the picture.

George H. Krapf: There are questions that have come up in discussions on this particular application of putting viscous fluids through lines. One of the questions that was posed to me was how you prevent the men from getting shocked when they take hold of the valves. Another question concerning the same type of valve was whether or not the valve should be insulated from electric current. In regard to pumps, the same problem arises—should the pumps be isolated from the current by insulation?

The problem of temperature control in this particular application brought up one other question. It is understood that it is easy to control the temperature in a moving, flowing system, but how can that be accomplished in a static system?

Warren A. Pond: In answer to the question about electric shock, the systems are operated on 24 volts or less, which is non-shocking. Insulating type transformers are used, and specifications require the system be grounded in one place. This means that all parts of the piping system must be insulated from ground. Because we are dealing in low voltages, the dielectric strength of the electrical insulation is not critical. Actually cambric tape, or something similar is suitable from the dielectric standpoint. However, from the abrasion and vibration standpoint, it is not good. We suggest other types of fibrous material.

The temperature of the pipe wall governs the operation. During flow conditions the fluid itself will usually maintain proper pipe temperature unless very long lines or very low flow rates are involved, in which case the electric heat supplements and assures uniform pipe and fluid temperature. The main function is to maintain pipe temperature and, therefore, fluid temperature, during static conditions. By this means, viscosity is kept constant, and pump loads at a minimum when flow is re-established.

H. C. Whiston: Will the entire system be insulated electrically, including the burners?

Warren A. Pond: That is right. There is a simple means of insulating, by putting what is called an insulated pipe joint in the pipeline, which stops the flow of current at any given point.

H. C. Whiston: Then you can shut down and start up again with this system with the line full of pitch?

Warren A. Pond: Absolutely.

H. C. Whiston: What would be the power requirements in starting up?

Warren A. Pond: The power required is only to raise the pipe plus contents from minimum ambient to desired maintained temperature. Say, in the case of pitch, from 0 F to 300 F.

H. C. Whiston: How many kilowatts are required?

Warren A. Pond: Off hand I cannot say. On pitch, for instance, I am not too familiar with the heats of fusion. Very often changing the state of a material requires the greatest heat input.

Member: Where do you have an installation such as this?

Warren A. Pond: We have an installation at Wheeling Steel. It has not as yet been completed. They have an existing loop system for tar, which they are using for pitch. This main has not been equipped with thermal electric as yet. The take-offs from this main to 7 of the 11 open hearths are now equipped with electric heat. These are working on the basis of single line discharge. When the conversion is complete, the pitch system from discharge steam heaters to all open hearths will be on a single pipe discharge arrangement.

I have been told that Wheeling has burned over a million gallons of pitch since the installation of the electric system and the operation has been highly successful.

George H. Krapf: I might ask what happens if we have a power failure?

Warren A. Pond: As far as power failure is concerned, if, for instance, there are electric pumps involved, they will be shut down as well, stopping the flow. If steam pumps are involved, I might ask what happens when there is a steam failure, or a freeze-up in traced or jacketed lines due to trap failure?

We have found that most large modern plants are very dependent on electricity, and continuity of service is closely guarded. Usually, there is an emergency supply of current, to handle the most important equipment.

As pointed out in the paper, after a shutdown, whether it be intentional or accidental, the electric system has sufficient capacity to melt out and raise the pipe and contents to design temperature. Because the heat is applied to the point of friction, the pipe wall, pumping can be established before the entire pipe content is up to design temperature.

R. A. Lambert: In addition to objections for a thermal heating system, another objection to a single feed line is, that, in most steel plants, the water and power lines, or any utility of prime importance, require a second line in order to assure continuous operation. The second line in a loop system can be used in case the normal feed line fails. That is one of the reasons I would hesitate to consider the elimination of that second line.

Warren A. Pond: Mr. Lambert's point about the two lines is a little hard to dispute, except I might ask him if he has two loops. It is hard to know when to stop having emergency and stand-by equipment. It is not often that pitch is the primary fuel. If a failure occurs, usually there are other fuels available to carry the load.

R. A. Lambert: In the Wheeling installation, are they retaining the loop and providing the steam tracer to supplement the electrical heating in case of a power failure?

Warren A. Pond: No, they are not. There is an existing loop presently installed. One of these lines will be equipped with electric heat and will serve as a main, or header, without return. It happens that this piping is an old tar loop, portions of which will be adapted for the new single line system.

ASSOCIATION OF IRON AND STEEL ENGINEERS

The Engineering Society of the Iron and Steel Industry

Activities

• The Association of Iron and Steel Engineers is an organization composed of the executive, engineering, operating and maintenance personnel of the iron and steel industry, as well as representatives of manufacturers of steel plant equipment and supplies. To accomplish its purpose of advancing the technical and engineering phases of the production and processing of iron and steel, the Association maintains a well-balanced program of activities designed not only to inform its members of the latest developments in engineering and operating practices of the industry, but to appraise their value as demonstrated by practical experience.

Achievements

Among its many achievements in which the Association takes pride are:

• Launched an industry safety movement in 1908, and in 1912 fostered the formation of a separate safety organization which became the National Safety Council.

• Promoted the application of electric motors on rolling mill drives, and the broad electrification of auxiliary machines.

• Furthered the development and application of combustion control and instrumentation as applied to the various processes.

• Influenced improvements in the design and application of modern types of bearings to mill equipment.

• Helped in the application of lubrication devices in the steel industry.

• Effected close cooperation between the industry's engineers and the manufacturers of equipment and supplies.

• Accomplished much valuable standardization work, such as the standard specifications for d-c mill type motors, mill type cranes, etc.

• Sponsored a number of technical research and educational projects.

• Carried on a constant program of disseminating information on latest developments and improvements in every phase of iron and steel production.

Publications

• The IRON AND STEEL ENGINEER, which is published by the Association of Iron and Steel Engineers, is a monthly engineering journal devoted exclusively to the engineering and operation of the iron and steel producing plants. The published material which is original and complete, deals with the problems of these plants, and consists of detailed technical papers by leading authorities on every branch of steel plant design, construction, operation and maintenance. It is editorially unique in that the content is to a great extent either contributed or suggested by the readers themselves. In addition to the regular articles, publication of the discussions reported in the various Association meetings gives a wide range of opinions and viewpoints concerning the subjects covered in the papers themselves. Distinctive editorial features and attractive physical make-up combine to establish the IRON AND STEEL ENGINEER as the outstanding technical magazine serving the industry. Every issue will bring the progressive steel plant engineer ideas which will aid in solving his own plant problems.

• Each year the proceedings of the Association are permanently bound and available to the members. This book, a welcome addition to every engineering library, provides a valuable reference affording comprehensive information over a wide range of selected steel plant subjects — a fund of data available in no other place.

Membership Qualifications

ACTIVE MEMBERS — Active members shall be persons not less than 21 years of age, actively identified with or having responsible charge of technical engineering, or supervisory work in the iron and steel industry.

ASSOCIATE MEMBERS — Associate members shall be persons not less than 21 years of age, actively identified with a company supplying equipment, material or service to the iron and steel industry, or identified with allied industries.

JUNIOR MEMBERS — Junior members shall be citizens of the United States or Canada, shall be persons identified with the iron and steel industry, shall not be less than 18 years of age, and shall not be eligible for membership under any other classification. After his 27th birthday, a junior member's classification shall automatically become active or associate. Yearly dues shall change accordingly, and no entrance fee shall be required to make the transfer. There shall be no foreign junior membership.

APPLICATION FOR MEMBERSHIP

Date_____

TO THE BOARD OF DIRECTORS:

Application is hereby made to the Association of Iron and Steel Engineers for Active / Associate / Junior membership.

Immediately upon notification of such admission, I promise to pay fees (in U. S. funds) as required:

Active and Associate, U.S.A. and Canada	— Entrance fee $10.00;	Yearly dues $10.00
Active and Associate, Foreign	— Entrance fee $10.00;	Yearly dues $12.50
Junior	— No entrance fee;	Yearly dues $5.00

If admission is made after July 1, dues are one-half the yearly rate.

Signature_____

Age_____ Residence_____ St._____ City_____ State_____

State present position_____

Company_____

City_____ State_____

Give full record of general and technical education and/or professional career. If applying for active membership state how long you have been identified with the iron and steel industry.

_____

_____

_____

_____

Application to be signed by at least three members who know the applicant. If conditions render this impractical, the names of at least two engineers of recognized standing should be given as reference.

_____ _____

_____ _____

_____ _____

PRINT YOUR NAME AND MAILING ADDRESS:

Name_____

Street_____

City_____ State_____

Membership entitles one to the monthly issues of the IRON AND STEEL ENGINEER, the official publication of the Association of Iron and Steel Engineers, the privilege of attending all district section meetings (in Chicago, Birmingham, Buffalo, Detroit, Cleveland, Philadelphia and Pittsburgh), the privilege of attending the Annual Convention and Iron and Steel Exposition, the Spring Conference, and the regular inspection trips to steel plants.

Association of Iron and Steel Engineers, Empire Building, Pittsburgh 22, Pennsylvania

Applications for AISE Membership

Active

NELSON L. ARMITAGE
Soaking Pit Foreman
Granite City Steel Co.
Granite City, Ill.

C. C. BENTON
Superintendent Open Hearth and Bessemer
Algoma Steel Corp., Ltd.
Sault Ste. Marie, Ontario, Canada

DAVID L. BRENNER
Project Development Engineer
Columbia Geneva Steel Div.
United States Steel Corp.
Pittsburg, Calif.

F. J. DAVITT
General Foreman
Temper Rolling and Shearing
Kaiser Steel Corp.
Fontana, Calif.

WILLIAM D. DICOME
Roll Department Engineer
Bethlehem Pacific Coast Steel Corp.
South San Francisco, Calif.

NORMAN EYLER
Supervisor, Blast Furnaces
Ford Motor Co.
Dearborn, Mich.

BEN J. GOLTRA
General Foreman, Blast Furnace Dept.
Ford Motor Co.
Dearborn, Mich.

JOHN J. GRASSI
Maintenance Foreman
Ford Motor Co.
Blast Furnace and Coke Oven Div.
Dearborn, Mich.

ROBERT G. GRIFFITH
Turn Foreman No. 5 Smls. Hot Mill
National Tube Co.
Lorain, Ohio.

FLOYD HOSKINSON
Superintendent
Youngstown Sheet & Tube Co.
Cold Drawn Bar Dept.
Youngstown, Ohio.

RALPH D. KILLIAN, JR.
Blast Furnace Foreman
Ford Motor Co.
Dearborn, Mich.

TAKAYUKI KURODA
Managing Director, Factory
Nippon Tokushu Steel Tube Co. Ltd.
Tokyo, Japan

GEORGE LUCHTAN
Maintenance Foreman
Ford Motor Co.
Dearborn, Mich.

T. S. MARLOR
Project Development Engineer
Columbia Geneva Steel Div.
United States Steel Corp.
Pittsburg, Calif.

H. F. MILLER
Fuel Engineer
Bethlehem Steel Co.
Bethlehem, Pa.

ERVIN C. MOUDY
Electrical Design Engineer
Columbia Geneva Steel Div.
United States Steel Corp.
Pittsburg, Calif.

WILBUR M. PATTISON
Steel Mill Foreman
Great Lakes Steel Corp.
Ecorse, Detroit, Mich.

MICHAEL POJEN
Foreman
Ford Motor Co.
Dearborn, Mich.

OREST SAWULA
Roll Shop Draftsman
The Steel Co. of Canada, Ltd.
Hamilton, Ontario, Canada

GEORGE W. SEMLER
Sales Manager
United Oil Co.
Pittsburgh, Pa.

GEORGE F. SHUMAKER, JR.
Electric Control Engineer
Bethlehem Steel Co.
Johnstown, Pa.

WILLIAM O. STAUDENMAYER
General Foreman Maintenance
Kaiser Steel Corp.
Fontana, Calif.

HARRY A. STORY
Detailer
American Steel & Wire Div.
United States Steel Corp.
Cleveland, Ohio.

KENNETH R. UTTER
Supervisory Conference Leader
Ford Motor Co.
Steel Division
Dearborn, Mich.

EVERETT D. WELLS, JR.
Draftsman
Jones & Laughlin Steel Corp.
Pittsburgh, Pa.

ELDON L. YESBERGER
Division Superintendent
Finishing Rolling
American Steel & Wire Div.
United States Steel Corp.
Duluth, Minn.

HIROSHI YOSHIDA
Manager Rolling Mill
Kawasaki Steel Corp.
Chiba, Japan

Associate

PAUL ANDERSON, JR.
Sales Engineer
Harnischfeger Corp.
Syracuse, N. Y.

A. S. BLODGET, JR.
District Manager
Air Reduction Sales Div.
Air Reduction Co., Inc.
Pittsburgh, Pa.

H. BONGARTEN
Superintendent, Service Shop
General Electric Co.
Youngstown, Ohio.

CARL F. BRASS, JR.
Vice President
Maser Machinery & Construction Co., Inc.
Pittsburgh, Pa.

F. W. CHAPPELL
District Sales Manager
Manning, Maxwell & Moore, Inc.
Pittsburgh, Pa.

HARVEY CHILDS
District Sales Manager
Birdsboro Steel Foundry & Machine Co.
Pittsburgh, Pa.

DONALD A. DAY
Service Engineer
Dowell, Inc.
Dow Chemical Co.
Tulsa, Okla.

FRANK ERNEST FAULHABER
Engineering Staff Project Engineer
Reynolds Metals Co.
McCook, Ill.

J. G. FORSTER, JR.
Salesman
K-W Battery Co., Inc.
Skokie, Ill.

FRANK D. HAZEN
President
Hazen Engineering Co.
Pittsburgh, Pa.

ROBERT J. KROTH
District Manager
Askania Regulator Co.
Philadelphia, Pa.

EDWARD C. LEVY, JR.
Engineer
Edw. C. Levy Co.
Detroit, Mich.

ARTHUR M. MARTIN
General Manager
All States Painting & Maintenance Co.
Detroit, Mich.

JOHN MONTORO
Design and Application Engineer
Westinghouse Electric Corp.
Buffalo, N. Y.

R. F. PASSANO
Partner
Coverdale & Colpitts
New York, N. Y.

RUDOLPH R. PATRICK
Mechanical Engineer
Wellman Engineering Co.
Cleveland, Ohio

ROBERT STONER
Sales Engineer
F. R. Magill Co.
Pittsburgh, Pa.

HARRY S. SULLIVAN
Assistant Plant Engineer
Dodge Forge Co.
Detroit, Mich.

RALPH R. SWAIN
Sales Engineer
Bailey Meter Co.
Cleveland, Ohio

RICHARD F. URICH
Secretary
Maser Machinery & Construction Co.
Pittsburgh, Pa.

ERNEST R. VILLAIRE
Application Engineer
Arthur B. Sonneborn Co.
Detroit, Mich.

JOHN WRIGHT
Sales and Service Manager
Coast Metals (Canada), Ltd.
Hamilton, Ontario, Canada

Junior

WILLIAM L. BACHTEL
Production Assistant
Kaiser Steel Corp.
Fontana, Calif.

Rolling Mill Yield

By LEO R. SILLIMAN
Superintendent of Conservation
Republic Steel Corp.
Buffalo, N. Y.

. . . . effective productive capacity may also be increased as a result of detailed yield studies . . . .

▲THIS paper describes some actual experiences and studies of fundamental practices affecting billet and bar yields which indicate their importance in a program directed at yield and quality improvement. Good yield is good business when it is obtained by measures which do not detract from quality. In fact, our experience is that good quality is a prerequisite to favorable product yield. To be effective, a yield program depends upon ideas and efforts from all concerned personnel. Ideas need not concern radical changes of practice because more often the problem is to obtain better control or understanding of processing factors known to affect product yield. The constantly rising cost of steel production lends additional incentive to develop and establish practical controls of product yield during each step of processing. It is felt that the yield and quality benefits which may result from regulation of ingot delivery to soaking pits, and certain rolling or heating practices have not always been fully appreciated. The realization of such benefits requires daily attention to ingot, billet and bar handling as well as field and statistical studies of processing.

The data to be discussed were obtained in a steel plant producing hot top carbon and alloy grades as well as rimmed and semikilled steels in analyses ranges from 0.05 per cent carbon to file grades. Heats are produced in 125-net ton and 250-net ton open hearth furnaces and are poured in 23 x 25-in. flat sided molds. The hot top ingot is 100 in. long including a 20-in. sinkhead and weighs 5.65 net ton. The semikilled ingot is 84 in. long and weighs 5.9 net ton while the rimmed ingot which is 79 in. long weighs 5.3 net ton. Ingots are rolled on a 38-in. blooming mill to a minimum size of 5⅜-in. square and can be further reduced to 4-in. square or smaller sizes on an 18-in. billet mill with no intermediate reheating. A desurfacing machine is ahead of the billet mill. Billets are rolled to bars on a 14-in., 10-in. or 8-in. finishing mill.

INGOT DELIVERY VS. YIELD

It has long been recognized that good ingot delivery to soaking pits will increase mold life, reduce heating time and cost, and improve surface quality. However,

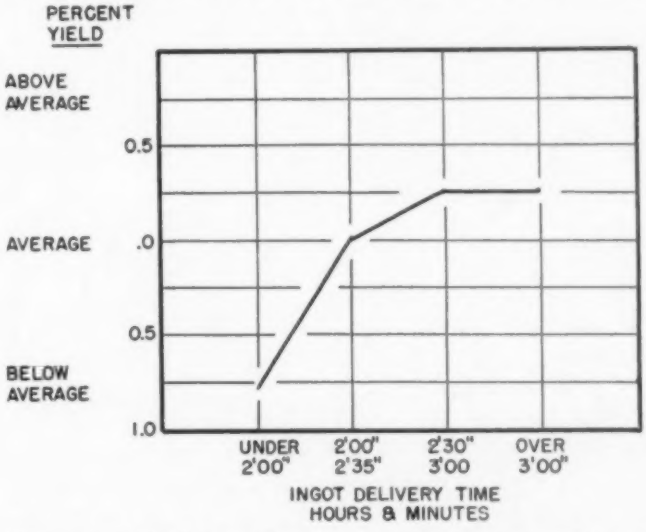


Figure 1 — Yield is increased as ingot delivery time is increased.

it is not always economically sound to move hot topped ingots too quickly, because internal quality can be damaged and thus offset some of the advantages of good ingot delivery. Several studies of large tonnage hot topped items have shown a direct relationship be-

tween ingot delivery, soaking pit time and billet yields. Figure 1, which illustrates the effect of ingot delivery time on hot top yield covers 8000 net ton of AISI C-1045 for the same end use. Billet testing and inspection procedure provided an accurate record of all scrap due to pipe and segregation. One hour and forty-five minutes is the specified time that ingots are held before moving after pouring, although occasionally heats are moved faster to utilize soaking pit space. The chart shows that yields were lowered 1.1 per cent due to pipe

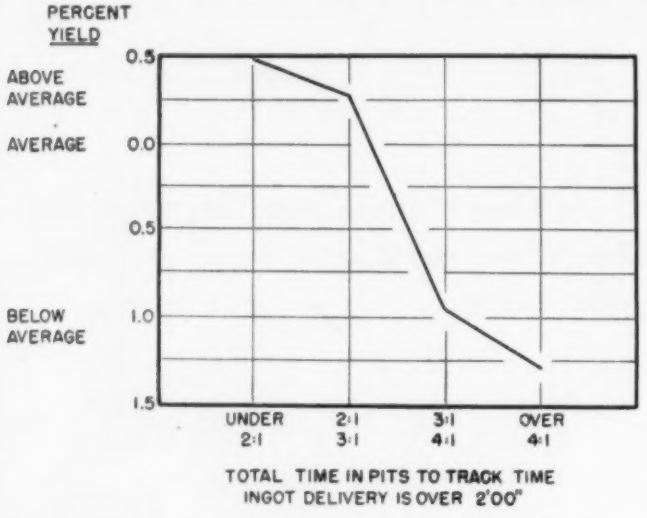


Figure 2 — Yield is decreased as time in soaking pits is increased.

and segregation when heats with total elapsed track time under 2 hr 0 min were compared to those exceeding 2 hr 30 min. Since long ingot delivery increases the time ingots must be held in the pits, attention must be directed at prompt delivery after ingots have held the minimum time required for good quality.

After delivery, the shortest soaking pit time necessary for good rolling practice is of major importance in

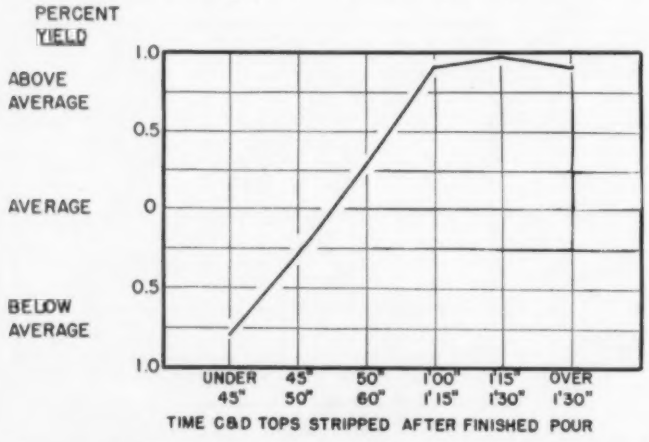


Figure 3 — When hot tops are stripped too soon, yield is decreased.

minimizing yield losses. The effect of soaking time on yields is shown in Figure 2 by using the ratio of time ingots are in the pits to ingot delivery time as a measure of soaking pit practice. Again, AISI C-1045 was used for study and since track time under 2 hr 0 min has already been shown to penalize yields, only those heats with delivery over this figure were considered. Very little effect on yield is noted up to a soaking ratio of 3:1, but over this figure the yield loss increases up to 1.6 per cent. This is due to additional scaling of ingot surface when heating cycles are prolonged. While this scaling usually reduces seaminess, it is questionable that the resulting improvement of surface justifies the added heating cost.

Ingot delivery and soaking pit time is dependent to some extent on hot top stripping times. If hot tops are stripped too soon, internal quality will be damaged. Figure 3 shows the effect of hot top stripping time on yields due to variations in top quality. These data were obtained from three separate studies of AISI C-1045 steels covering 15,000 net ton of ingots. A loss of 1.6 per cent in yield resulted when tops were stripped less than one hour after pouring was completed. Low carbon grades could be stripped faster than the one hour shown, but with grades over 0.35 per cent carbon internal defects necessitated extra top croppage on billets. These results illustrate the effect of ingot handling on billet yields from hot top ingots and show the need for care to avoid yield losses sustained by moving ingots before they are completely solidified. However, everything that can be done to expedite ingot movement after proper holding times have been observed will reduce yield loss from excessive soaking time and will favor economical soaking pit operations.

SOAKING PIT PRACTICE VS SEMIKILLED YIELD

Variations in heating practice as well as the condition and type of soaking pits can have considerable

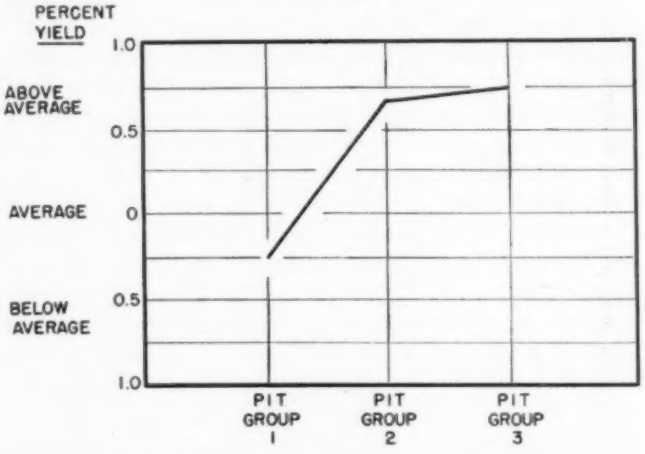


Figure 4 — Yield will vary by type of pits depending upon the practice.

effect on billet yields from semikilled ingots. Important open hearth variables were considered in analyzing soaking pit performance and only heats with good practice records were considered. The subject shop has both recuperative and regenerative pits. It was found that one block of recuperative pits consistently produced lower yields from semikilled ingots than other blocks. This is illustrated in Figure 4, which shows a loss of 0.9 per cent in billet yields from Group 1 because ingot tops were repeatedly overheated in the front location of these pits. This caused excessive croppage on billets because of slag pipe or checked surface. Group 2 are regenerative pits and Group 3 are the bal-

Figure 5 — This typical billet surface results from charging butt down in old soaking pit bottoms.

ance of recuperative pits which did not give trouble with overheated tops. Reasonable care in heating can minimize yield losses and studies are often necessary to determine which pits are currently giving the most trouble.

EFFECT OF HOT TOP CHARGING ON SURFACE

Normal practice for hot top ingots is to charge the hot top down in the soaking pits. A reversal of this practice often causes cold butts which need extra cropping because they split or will cause trouble in billet mill rolling. In addition, butt down charging also may allow scale or slag from old pit bottoms to weld to the ingot and this produces a scabby condition on billet surface as shown on a 7-in. square bloom in Figure 5.

Figure 6 is a close up of the same condition, illustrating a characteristic "burned" appearance. Figure 7 is a cross section of the same sample and shows that material from the pit bottom welded to the bloom in depths up to $\frac{1}{8}$-in. This condition either necessitates scrapping or otherwise prime material or incurs additional scarfing expense and metal loss during cleaning.

BLOOMING MILL ROLLING VS YIELD

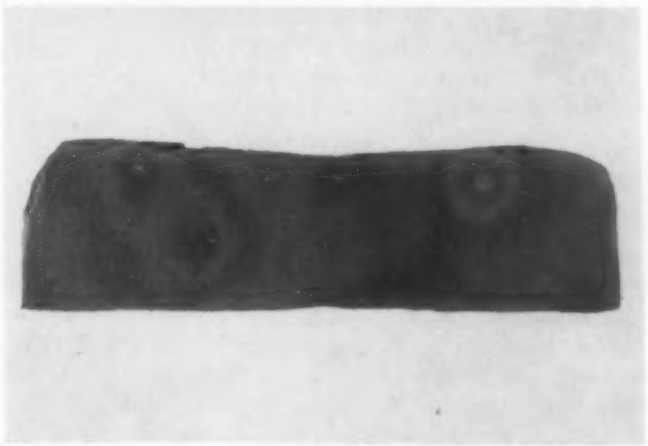
Blooming mill drafting practices can often affect the depth of surface tearing, which in turn is reflected in scrap loss and cleaning costs. It had been observed that often 7-in. square blooms required more scarfing on the sides as finished on the mill which was due usually to greater depth of defects, although at times a larger number of defects was also observed. Practice in rolling

Figure 6 — This is a close-up of condition mentioned in Figure 5 showing the heavier scale welded to the billet.

this size was to start with the 23-in. sides of the ingot against the rolls and take four squaring passes to produce a 19 x 21 in. section. The ingot was turned after each two squaring passes and was then slabbed to 12 x 19 in. before turning into the 12-in. pass. By this method the original 25-in. ingot sides were those which were slabbed and they finished as the sides on a 7-in. bloom, the location where defects were most troublesome.

A study of drafting practice was made by taking six instead of four squaring passes with balance of the rolling remaining the same. In order to eliminate all other variables possible, only heats with good open hearth practice records were used. Heats were charged in the

Figure 7 — Cross section of billet shown in Figure 6 shows material welded to billet up to $\frac{1}{8}$-in. in thickness.



soaking pits in order poured, rolled in the same order, and product of each ingot was identified. Alternate ingots were rolled with the extra squaring pass and all scarfing on finished billets was measured. The study was confined to AISI C-1045 which had been machined scarfed before conditioned by hand scarfing. This grade usually has good surface characteristics, so that any

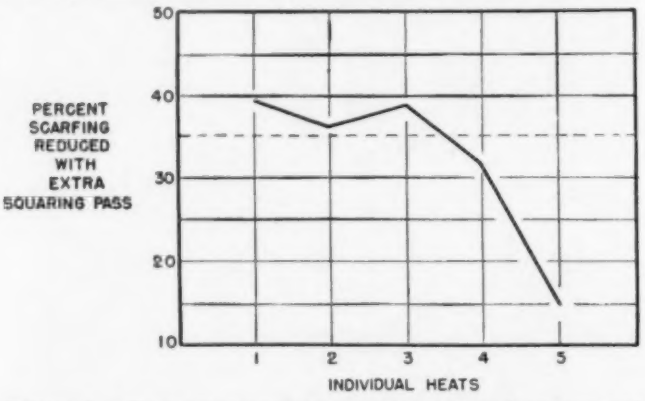


Figure 8 — Two extra squaring passes reduced amount of required hand scarfing an average of 35 per cent.

pronounced difference in billet surface quality produced by the drafting methods studied would be especially significant. The results on five heats in Figure 8 show that when two extra passes were used, the amount of hand scarfing required on billets was reduced by an average of 35 per cent. This improvement ranged from 15 per cent on an exceptionally good heat to 39 per cent on a fair heat, and was due to fewer and and shallower defects on the billet side that corresponds to the 25-in. side in the ingot. Figure 9 is a typical example to show surface quality variation within a

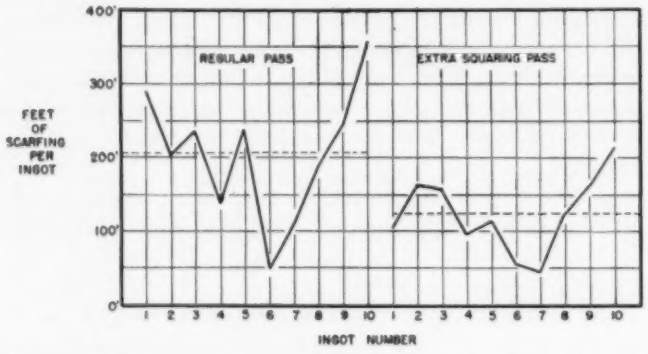


Figure 9 — The extra squaring pass reduces the amount of scarfing per ingot as shown in this diagram.

given heat. The savings realized through lower scarfing costs and fewer billet discards offset the slight increase of rolling time required to obtain them.

BILLET SURFACE VS BAR SURFACE

The surface quality of finished bar mill products is governed to an important degree by the condition of blooms or billets from which they are rolled. If defects are excessive, the amount of scarfing necessary to remove them may result in rejections of finished products as well as high cleaning costs. Some heating and rolling practices also may affect finished bar surface quality. There are many times when a moderate amount of conditioning will be detrimental to finished surface quality due to either a small amount of reduction from billet to bar or because a certain method of rolling is used. A common difficulty under such conditions is the folding in of scarf marks during bar mill rolling. This was studied in tests with a die rolled crankshaft section rolled from a 7-in. square billet.

The cross section of the finished die rolled blank approximates that of a 4-in. square. Scarfing was two cuts deep on the center area of one side of the billets selected while the opposite side was scarfed one cut deep. These billets were charged in the furnace with scarfed sides corresponding to the bosses on the finished section. Figure 10 shows a representative sample of each side after slabbing to 7¼ x 4 in. in two passes. The scarf

Figure 10 — Shown here are sides of 7-in. billets as charged in furnace after slabbing to 7¼ x 4-in. Scarf marks are folded in No. 3 side which was two cuts in depth. The opposite side which is one cut deep shows no folding.

marks have started to fold together on the No. 3 side which was scarfed two cuts in depth.

Figure 11 shows a cross section of tests cut after the slabbing pass. Scarfing is folding in on the upper side which was scarfed two cuts deep while the opposite side was scarfed one cut deep and is free of any scarf marks. As shown in Figure 12, scarf marks could still be seen where scarfing was two cuts deep, even after two edging passes had been made. The opposite sides are free of any scarf marks and the scarfing that has not rolled out at this time continued to fold in and elongate. The resulting marks appear as fine seams on the finished section and are shown in Figure 13. A change in method of rolling greatly reduced the amount of defects for this reason. However, even with less slabbing and more edging work done early in the breakdown, scarf marks were still noticeable in the finished section

Figure 11 — Cross section shows billets after slabbing. Upper side which was scarfed two cuts deep was folded in. The opposite sides are free of scarf marks.

if scarfing was deep and not well flared. Figure 14 shows crankshafts sections rolled with a revised set up and when billets had deep well flared scarfing. The scarf marks were not folded in tight and could be ground out. It is obvious that very little conditioning can be tolerated when billet to finished size reduction is small without increasing finishing cost and scrap loss. Well flared scarfing is necessary and attention to rolling methods can often effect major surface quality improvement.

The effect of billet to bar reduction on surface quality can be further illustrated by comparing rejections for three different crankshaft sections of the same grade of steel and rolled from a 7-in. square bloom. Figure 15 shows scrap due to seams on crank sections numbered 1 through 3 which are progressively larger in section. Data were compiled from 6000 net ton and the rejections increased 0.7 per cent from the smallest to the largest section. These results were confirmed in further studies.

Available bar mill soaking time and condition of surface on various sides of billets can also be utilized in efforts to reduce cleaning costs and rejections due to surface defects. The 14-in. mill furnace in the subject plant has dry skids and is top fired from one end. It has been proven repeatedly that the side of finished products which corresponds to the bottom of the billet in the furnace usually has the largest number of fine seams. Therefore, a trial was made with 7-in. square blooms where the side charged down in the furnace was skin scarfed in addition to removing all visible defects.

Figure 12 — After two edging passes, scarf marks can still be seen in the upper side.

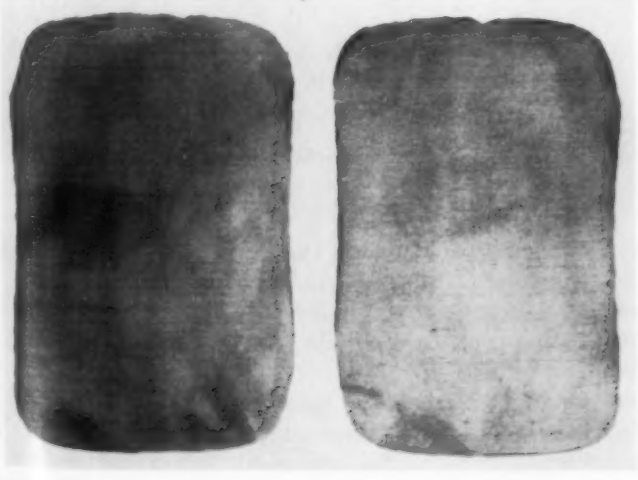
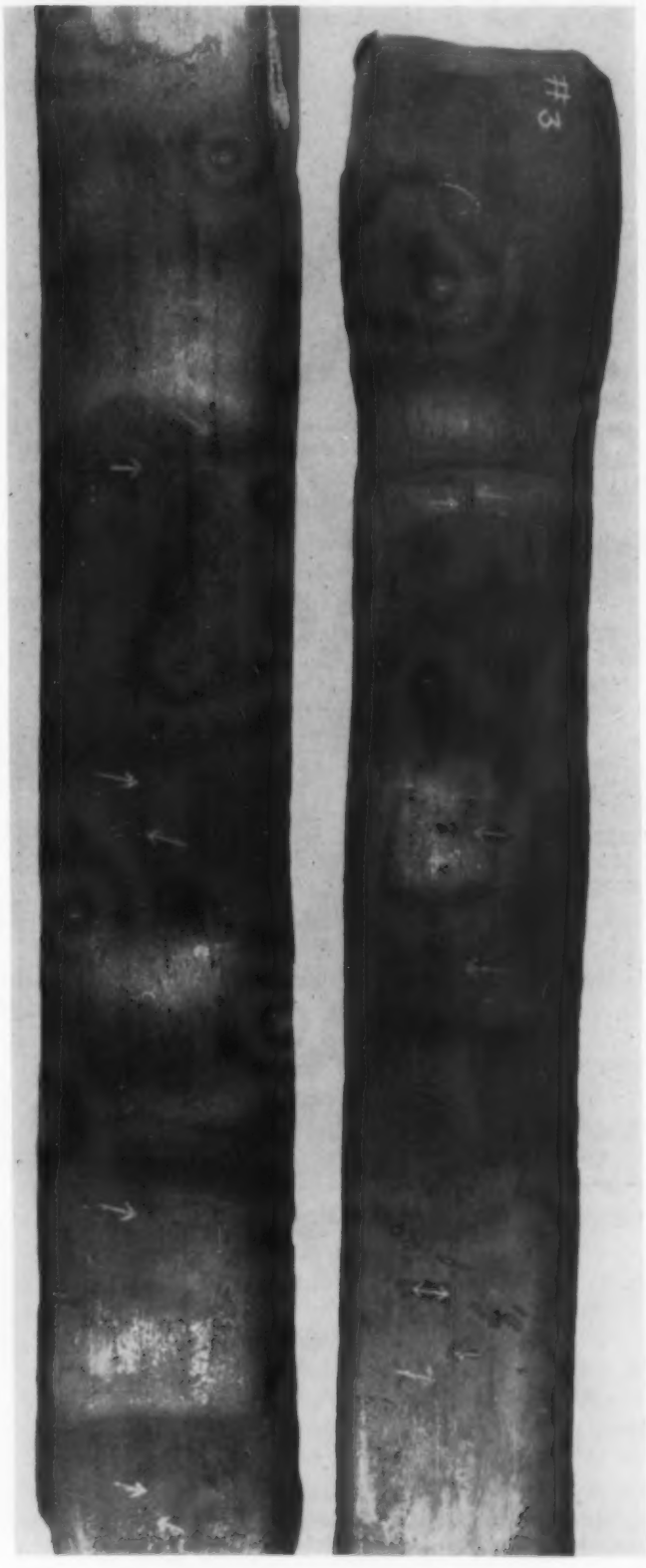


Figure 13 — Folded in scarf marks, from side scarf two cuts deep, appear as side seams in the finished crank.



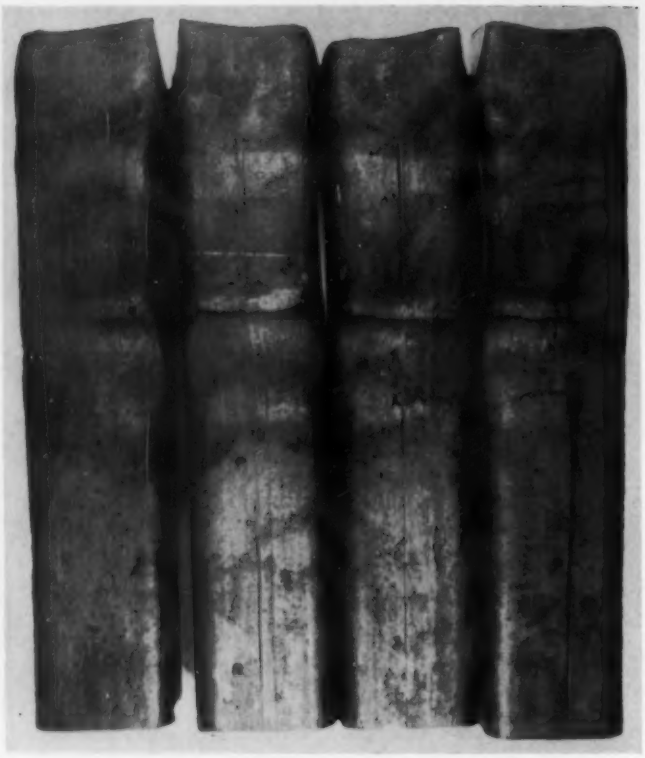


Figure 14 — Scarf marks in finished cranks from a revised rolling set-up are not as deep and can be more readily ground out.

Figure 16 illustrates the results by comparing grinding time on the finished product. The sides charged down in the furnace were compared with the opposite or top side which had normal scarfing but the most advantage from scaling in the furnace.

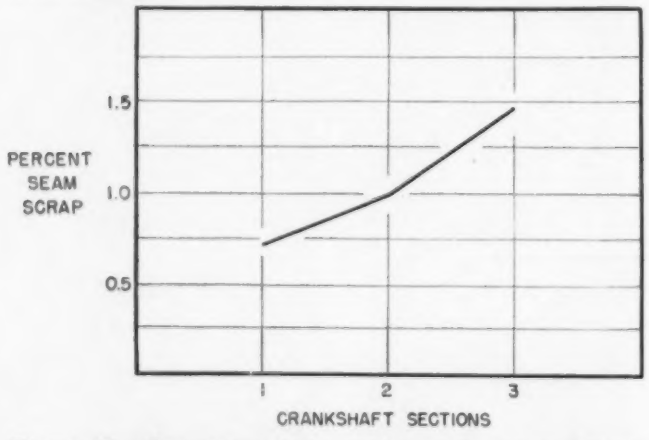


Figure 15 — Rejections because of seam scrap on crankshaft sections increase as the crankshaft size increased.

Many of the defects were light and it would not be necessary to remove them in practice. However, to accurately compare the factors involved, all visible defects were ground out of the finished section. Despite skin scarfing, seams were more numerous on the product sides corresponding to the bottom side in the furnace. However, the number and depth of defects were less than normally experienced. A longer soaking time was beneficial to both sides, but did not help the bottom portion as much as normal scaling on short soaking time did the top side. There are definite indications that changes in billet conditioning methods will improve finished bar surface at times, but there will be limits to this improvement because of undesirable bar mill furnace conditions that cannot be changed without considerable expenditure. Where economically feasible, increased soaking time will be of material benefit.

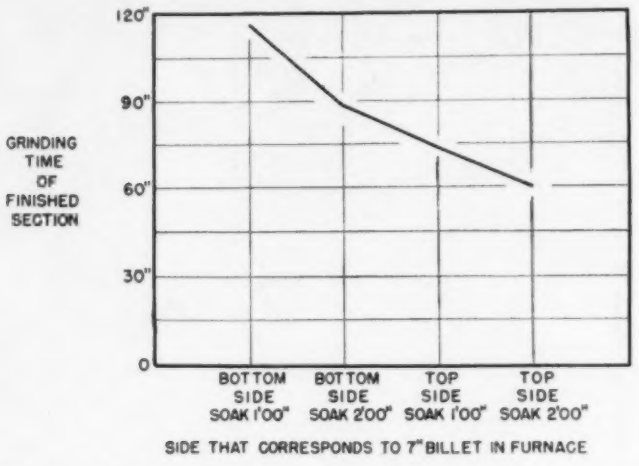


Figure 16 — More grinding is required on the bottom side than on the top side of the billet.

BILLET PROVISION AND WEIGHT VARIATION

The importance of proper billet provision for good bar mill yield cannot be stressed too strongly. It is often common practice to "overprovide" by ordering billet weights heavier than is needed to produce specified bar length plus normal croppage, and this results in waste due to excess crop loss. Detailed analysis of normal performance on billet weight variation, scarfing and scrap loss can usually help in minimizing such yield loss and establish a better basis for ordering billets for dead length bar cutting.

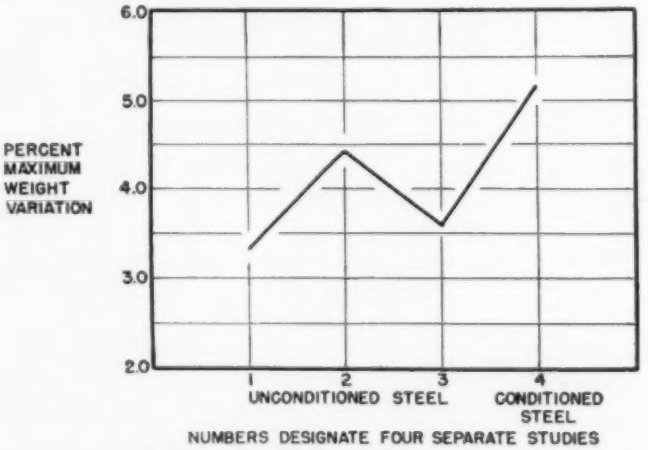


Figure 17 — Curve shows maximum billet mill weight variation from the theoretical 3-in. billets.

A billet weight study was made to determine variation that can be expected in the subject plant. Data were obtained from 250 heats on which billet samples were taken from top, middle and bottom of the first, middle and last ingots poured. Tests were cut to one foot lengths and weighed to determine weight variation from theoretical. Maximum variation that could be expected was about 4.5 per cent during this period.

Figure 17 shows the maximum variation on three separate studies of unconditioned steel for 3-in. billets and the added variation on a fourth trial caused by considering conditioning losses. The range within the three unconditioned studies varied from 3.3 to 4.4 per cent and when conditioned tonnage was used this figure increased to 5.2 per cent. Variation within the product from a single ingot was often found to be as great as the variation within a heat or between heats. This was believed due to temperature drop from front to back end of the bloom. However, total variation was considered normal since most heats were within the AISI allowable standards of plus or minus 2.5 per cent for billet weights.

Billets ordered for the bar mills must allow for all variables concerned such as weight variation, bar weight and length, and hot bed length. Variations such

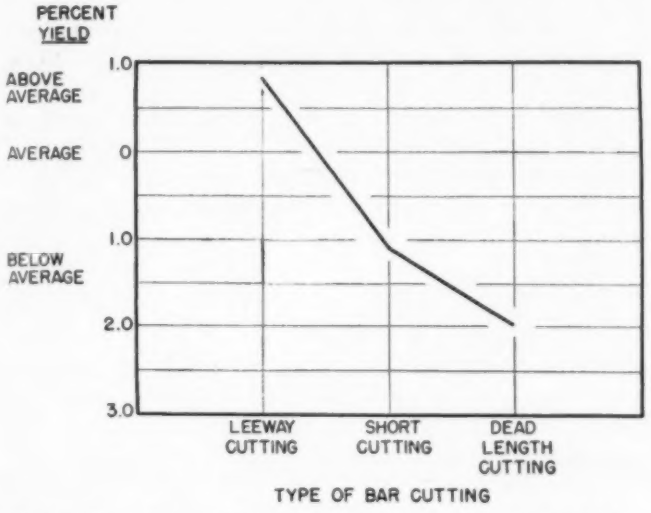


Figure 18 — Curve shows effect of bar cutting on yield.

as found in the billet weight study should not penalize leeway cutting. However, under the best of conditions, it appears that dead length cutting will suffer to some extent unless shorts can be applied to another order.

Figure 18 shows yield data obtained from a one-week study on the 10-in. bar mill when the range of round sizes normally rolled was fairly well covered. On the average, yields from leeway orders were good while a loss of 2.0 per cent occurred on dead length short cutting. A further loss of 0.8 per cent resulted on long dead length cutting. These are losses from the original application, but some shorts could be applied elsewhere at times so that actual scrap was not excessive. Although the drop in yield on dead length orders from leeway cutting is large, it cannot be considered excessive in view of billet mill weight variation and conditioning losses previously shown.

During this same period a study was made to determine the sources of major yield loss. Cobbles were the

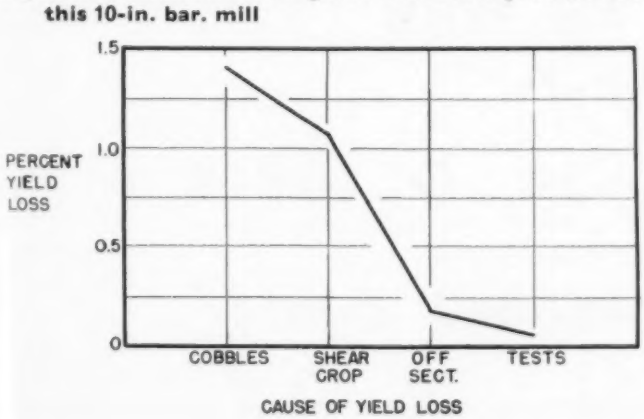


Figure 19 — Cobbles are the greatest source of yield loss on this 10-in. bar. mill

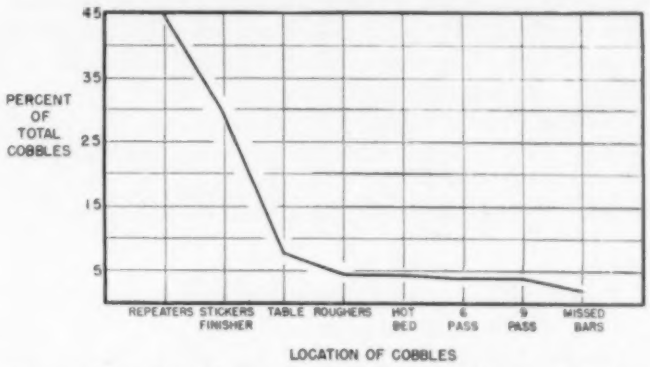


Figure 20 — Curve shows location of cobbles on 10-in bar mill.

greatest cause as shown in Figure 19. Crop loss was not considered excessive and cobble loss was as great as the total of all other losses. Therefore, an analysis of where cobbles occurred was felt to be of benefit. Figure 20 shows where the percentage of cobbles to the total occurred during this period. About 74 per cent of all cobbles were at the repeaters or finishing stand. Although operators are well aware of the location of cobbles and the periods when they are excessive, it is often of benefit to have data available as an aid in the reduction of this loss.

The production experiences described with rolling mill yields in the subject plant concern a few of the major items affecting yield and quality. Permanent gains in yields must come from improvements in basic practice, equipment and controls; with ingot handling, heating, rolling and cleaning performance instrumental in attaining good yields. One principle that is always necessary in improving yields is that high quality standards must be maintained.

DISCUSSION

PRESENTED BY

R. F. CAMERON, Plant Metallurgist, Wickwire Spencer Steel Division, Colorado Fuel & Iron Corp., Buffalo, N. Y.

LEO R. SILLIMAN, Superintendent of Conservation, Republic Steel Corp., Buffalo, N. Y.

RALPH D. HINDSON, Works Metallurgist, The Steel Co. of Canada, Ltd., Hamilton, Ontario, Canada.

R. F. Cameron: We concur with your results and data, Mr. Silliman, in regard to track time on holding hot-top heats. We use clay hot tops as compared to

your C&D. We find, that for our ingots which weigh about 6,000 lb, holding them 45 minutes after the last ingot is poured gives us good yield as far as hot top steel is concerned. In connection with your bar mill, do you roll to a standard yield from ingots to billets and have a standard diversion practice?

Leo R. Silliman: We have no standard yield from ingot to billets but cut the maximum product good quality will allow.

R. F. Cameron: What I had in mind, do you take and roll a standard weight or a standard number of billets from your ingots and then divert a standard weight or number of billets to obtain a standard yield before rolling in your bar mill?

Leo R. Silliman: Product will vary from ingots and this usually results in one or two billets shorter than the standard bar mill length.

R. F. Cameron: I wondered if you had a standard practice plus diversion or that you inspected everything.

Leo R. Silliman: All billets are inspected either at the rolling mill or steel conditioning.

Ralph D. Hindson: Your first two graphs showed the effects of track time and time in the soaking pits on yield. I have no particular argument with that, except I think you are studying a rather fine distinction in yield. In other words, are you going to get much of a variation in yield between two hours and three hours track time? I would think that your variation in croppage practice is greater than the variable you are studying in comparing track times between two and three hours. We find a drop in yield with long track time; certainly, after 6 or 7 hours your yield drops. But, how do you control your croppage practice close enough to show up such a fine distinction?

Leo R. Silliman: Data referring to the first and second charts were from tonnage of the same grade where macro etch tests are taken from the top end of all top cuts. By this method a fairly accurate measure of product yield can be made. It was felt that some of the variations in shearing would be of minor importance when studying large tonnages of the same grade and application.

Ralph D. Hindson: How about your variation in croppage in the blooming mill which could vary the yield within a half of a percentage?

Leo R. Silliman: Product is measured and as the butt crop is standard, the variation in length is an accurate measure of top quality.

Ralph D. Hindson: How do you control croppage in your bloom mill and your billet mill? When you are rolling an ingot, how do you determine how much to cut under a hot-top? Is it by sight or do you use a gauge?

Leo R. Silliman: The shearman determines by sight the distance necessary to cut from the hot top junction.

Choose the men in your department now who will attend the . . .

1953 ANNUAL CONVENTION

OF THE

ASSOCIATION OF IRON AND STEEL ENGINEERS

HOTEL WILLIAM PENN

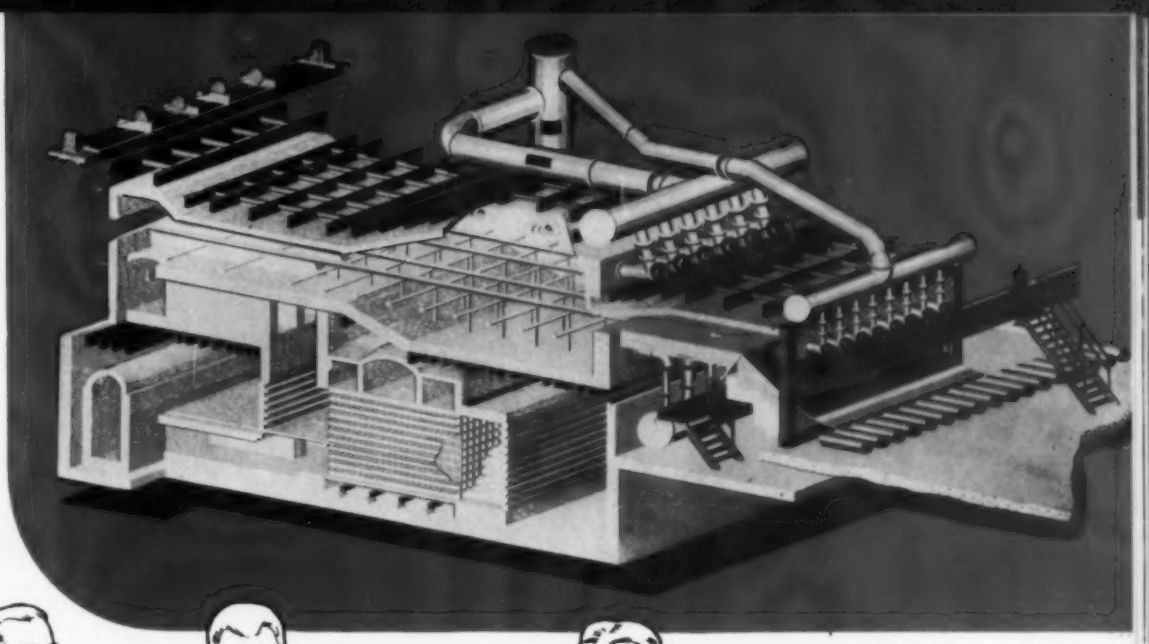
PITTSBURGH, PA.

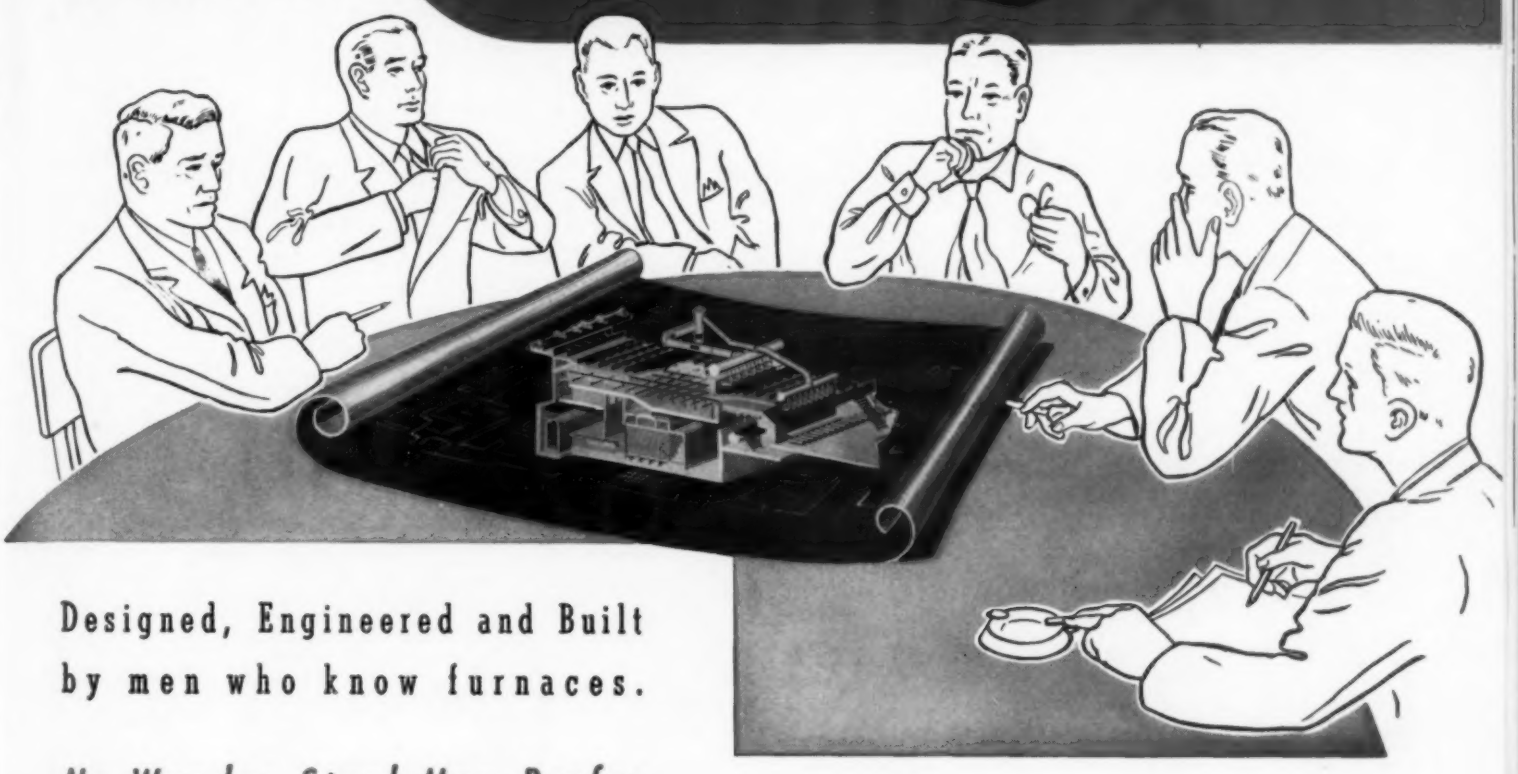
SEPTEMBER 28, 29, 30, OCTOBER 1

Make hotel reservations today!

for better reheating

SLABS
BLOOMS
BILLETS
BARS, ETC.





Designed, Engineered and Built by men who know furnaces.

No Wonder Steel Men Prefer

RUST CONTINUOUS REHEATING FURNACES

for Accurate Temperature Control • High Capacity • Economy

Rust's patented zone-controlled, double or triple-fired, recuperative, continuous furnaces are individually designed to meet specific needs. Each furnace provides positive automatic control of predetermined heating temperature. Flexibility is achieved by simply changing the fuel firing rate in the heating zone. The result is high tonnage output with minimum fuel consumption. In addition to reheating furnaces, Rust builds other types (designed for any fuel) to meet practically all metallurgical heating needs. For either new or modernization projects rely on Rust for the complete job.

THE WHOLE JOB IS ONE JOB WITH A

"RUST PACKAGE CONTRACT"

One contract covers everything . . . from blueprint through start up. Rust assumes responsibility for design, manufacture, erection, and is prepared to undertake all phases of the work with its own forces, including wiring and piping. This results in substantial savings . . . One profit instead of pyramiding ones which accrue where many subs are employed.

RUST FURNACE COMPANY

Pioneers in Furnace Design

RUST BUILDING PITTSBURGH, PA.

F-9

HINTS FOR SEALING STORAGE BATTERY CELLS

▲ USERS of storage batteries sometimes find it necessary to remove the cover from a cell for internal inspection and repairs. In reassembling the cell unit, it is essential that a proper seal be obtained between the cover and the jar. Gould-National Batteries, Inc. offers these eight tips to good results:

1. Use the right compound. Ask your battery manufacturer what compound to use. In most cases battery makers will supply sealing compound packaged, ready for use.

2. To melt the compound, almost any convenient source of heat may be used such as a gas burner, electric hot plate or blow torch. Do not raise the temperature of the compound higher than necessary to permit easy pouring of the melted compound.

3. Do not permit the compound to burst into flames because burning consumes the oil in the compound. Loss of oil impairs its effectiveness. Too rapid heating and too high temperatures cause the compound to catch on fire.

4. Almost any metal saucepan or aluminum coffee pot may be used to melt the compound. It is important, however, that the melting pot has a good pouring lip so that the melted compound can be directed into place accurately with a minimum of spilling.

5. Do not use too large a pot because more time will be required completely to melt than a smaller batch. A container holding about one quart is generally used. If some compound remains after pouring a seal, it may be cooled, stored and reused. However, when the compound is being reheated, do not puncture the unmelted top layer with a screwdriver or other pointed tool because pressure in the lower section of melted compound may cause hot, melted compound to squirt up through the hole. The hands, face or body of persons near by may be severely burned.

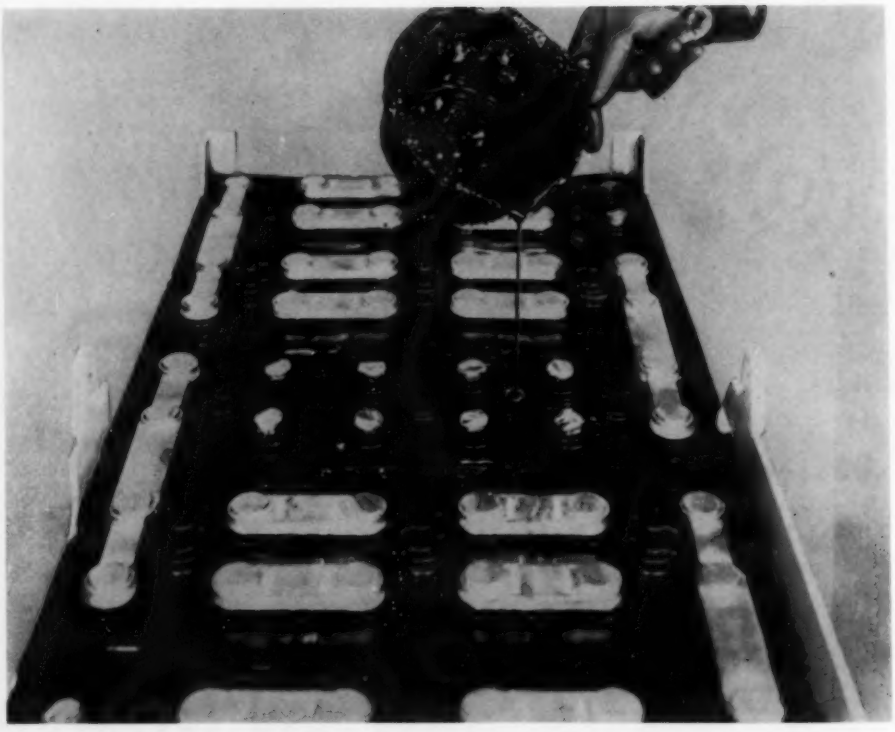


Figure 1 — A good pouring lip is necessary in order to direct the melted compound accurately into place.

6. Clean the surfaces to be sealed, neutralize with ammonia or baking soda and dry all surfaces carefully.

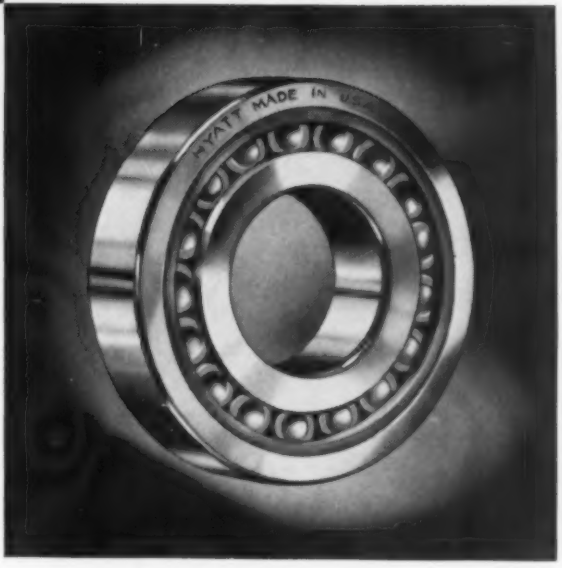
7. Be sure the cover is properly seated on top of the cell and is level with other cell covers in the battery.

8. Pour the sealing compound into space between the cover and the jar being careful to avoid spilling. It is important to fill the space to the same level as the other cells in the battery so that there are no recesses where acid spray can collect. Use a sharp compound knife to smooth over rough spots and to remove excess compound after the compound has solidified.

UNMATCHED TESTING FACILITIES...

one of many reasons for Hyatt leadership!

In testing laboratory or manufacturing plant, Hyatt's facilities are second to none. Continuing research in methods and materials, and exacting inspection with the finest in modern equipment, has made the Hyatt name a synonym for "highest quality." That's why Hyatt Roller Bearings are so widely used in tables, cars, cranes and other steel mill equipment. Design engineers know that Hyatt bearings ease shock loads, extend equipment life and reduce operating costs. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.



HYATT ROLLER BEARINGS

"We Saved Money and got better Protection for TWO Customers by switching to FUSETRON *dual-element* FUSES"

"Fusetron Fuses made it possible to use smaller size switch."

"Early this year I had the opportunity to lay out a wiring job for the Nehi Bottling Works at Boise, Idaho.

"After figuring the job with ordinary fuses it was found necessary to use a 400 ampere 250 volt main switch to carry the load.

"The proprietor of the bottling works felt that the cost was too great. I, therefore, refigured the job with Fusetron fuses and I found that I could use a 200 ampere 250 volt switch which besides being less expensive would result in better protection.

"Needless to say the proprietor was happier with the lower cost and I received the electrical contract."

Start Saving

FUSETRON dual-element FUSES do more than protect against short-circuits —they give 10 POINT PROTECTION

1 Protect against short-circuits.*

2 Protect against needless blows caused by harmless overloads.

3 Protect against needless blows caused by excessive heating — lesser resistance results in much cooler operation.

4 Provide thermal protection — for panels and switches against damage from heating due to poor contact.

5 Protect motors against burnout from overloading.

6 Protect motors against burnout due to single phasing.

7 Give DOUBLE burnout protection to large motors — without extra cost.

8 Make protection of small motors simple and inexpensive.

9 Protect against waste of space and money— permit use of proper size switches and panels.

10 Protect coils, transformers and solenoids against burnout.

*Fusetron Fuses have high interrupting capacity as shown by tests of the Electrical Testing Laboratories of New York City in December, 1947.

FUSETRON is a trade mark of the Bussmann Mfg. Co., Division of McGraw Electric Co.

One needless shutdown . . . one lost motor . . . one destroyed switch or panel . . . one burned out solenoid . . . may cost you far more than replacing every ordinary fuse with a FUSETRON dual-element fuse **now!**

"Heating in a main switch was causing fuses to blow until a Wholesaler's Salesman showed us how to cure the trouble with FUSETRON dual-element Fuses."

"During 1948 I was confronted with a bad heating problem in a 600 ampere 250 volt switch at Falk's Department Store, Boise, Idaho.

"When we checked the load on the switch we found that only 380 amperes were flowing. Even with this load the ordinary fuses used would melt and open every 30 to 90 days.

"The result of these fuse blows was confusion and annoyance to both customers and employees.

"At the suggestion of a local wholesaler's salesman 600 ampere 250 volt Fusetron dual-element Fuses were installed.

"The heating in the switch stopped immediately and we have not had that type of trouble since."

R. M. Alloway
Alloway Electric Co.,
Boise, Idaho.

FOR INFORMATION, MAIL THIS COUPON TODAY . .

BUSSMANN Mfg. Co. (Division of McGraw Electric Co.)
University at Jefferson, St. Louis 7, Mo.

Please send me complete facts about FUSETRON dual-element Fuses.

*Name*_____

*Title*_____

*Company*_____

*Address*_____

*City & Zone*_____ *State*_____ 753

with Fusetron Fuses

NEW SAFETY HOOK BLOCK WILL REDUCE CRANE ACCIDENTS

. . . . a fertile field for crane accidents should be eliminated by this device . . . .

▲ A new and revolutionary development which will make safer crane operation and which will reduce accidents in plants was unveiled by The Alliance Machine Co. to a group of steel operators from all over the country at a demonstration recently at Alliance, Ohio. The idea is so simple that the chief comment was why no one had thought of it before. However, its simplicity is an asset in construction and maintenance as well as in the initial cost of the equipment.

Although crane accidents do not often happen, one of the more common occurs when the lifting block is run up too fast, or when the limit switch either is not set properly or fails to operate, with the result that when the block hits the trolley, the hoist ropes break and the equipment falls to the mill floor. The device shown consists of nothing more than a spring system introduced between the hook block and the lifting beam. To insure proper operation, the springs must be designed with sufficient capacity to absorb the kinetic energy of all rotating and moving parts, and the lifting beam must be strong enough to absorb the impact force. It is relatively easy to either design the lifting beam or reinforce it so as to have sufficient strength to withstand the impact flow. The equipment can easily be designed into new cranes or adapted to existing units. At the plant a spectacular demonstration was put on when a hook block on one crane was run at high speed on a crane not equipped with this spring mechanism with the result that the hoist ropes broke and the hook block, etc. fell to the floor. The group then moved on to another crane in which the mechanism had been mounted onto the hoist block, and a number of runs were made in which the hook block was run up against the lifting beam. In every case, the mechanism absorbed the shock even though in a number of runs the hook block was swinging violently, an added demonstration to show that it would work under all conditions.

The safety hook block, shown on Figure 1, is equipped with springs to absorb the kinetic energy of the revolving parts of the hoist mechanism, without exceeding safe load on the hoisting ropes. It thus prevents dropping the hook block which can now occur if the hook block is accidently run up until it engages the lifting beam.

Figure 1 shows a typical crane trolley with hook block, the hook block is equipped with compression springs whose stroke and capacity is somewhat greater than the foot pounds of stored energy in the revolving parts of the hoist.

Series motors, normally used on cranes, are variable speed motors whose speed varies inversely as the load. In the present case the armature has a speed of 400 rpm, based on the ½-hour crane rating of the motor. The total energy stored up in the revolving parts of the hoist amount to 10,505 ft lb when the motor is revolving at 400 rpm.

Under light-load, or no-load conditions, the armature often attains a speed of 2½ times the half-hour rating, and since the stored energy in the revolving parts varies as the square of the speed, the total kinetic energy stored up in the revolving parts would be the square of 2½ or 6¼ times the 10,505 ft lb of energy at 400 rpm, making a total stored energy of 65,650 ft lb at 1000 rpm.

The breaking strength of one ⅞-in. rope is 61,000 lb using plow steel hoisting rope, having six strands of 37 wires each. With a factor of safety of 3 in the ropes, it is possible to stress a ⅞-in. rope to 20,333 lb. Since, in example shown there are eight ropes, we obtain the maximum force applied to the total number of springs by multiplying the maximum safe load of one rope by the number of ropes, which in this case is eight, or 20,333 × 8 = 162,664 lb. The average force exerted by the springs is $\frac{162{,}664}{2} =$ 81,332 lb.

The deflection of the springs to absorb the kinetic energy of the hoist revolving parts is therefore $\frac{65{,}650}{81{,}332} =$ 0.81 ft or 9.7 in.

In figuring the necessary springs to

absorb the kinetic energy of the revolving hoist mechanism, care must be exercised not to exceed the safe stress on the hoisting ropes. In the example above we used a factor of safety of three. In some cases a higher factor of safety may be desirable. Since the energy absorbing power of the springs is a function of the maximum safe load that can be applied, times the stroke, it is necessary to select springs whose maximum safe capacity is such that too great a deflection will not be required. A deflection range from six inches to a foot would not be excessive for an application of this type.

In most cases the weight of the hook block will prevent a series motor from attaining a speed greater than 2½ times the half-hour rating or crane rating of the motor. In case it does not, however, it is a very easy matter to apply a slight armature shunt which will supply the necessary ampere turns in the field to prevent the motor from attaining a speed greater than 2½ times the half-hour rating under no-load conditions.

In the case of a-c cranes, where the hoisting speed can never exceed the synchronous speed of the motor, the application of springs to absorb the energy of the revolving parts of the hoist becomes a much more simple problem, and the springs do not need to be as heavy as is the case with a series motor, unless high-speed a-c motors are used.

At the present time, practically all the electric overhead traveling cranes are equipped with an electrical limit switch. This switch is normally actuated by the hook block and in almost every case is a very effective means for preventing over-travel of the hook block. There are occasions, however, where for lack of proper maintenance or failure of the operating mechanism, the limit switch is rendered inoperative, and under these conditions if the controller is not moved to the off position in sufficient time, the hook block is brought into engagement with the lifting beam, resulting in the inertia of the revolving parts, breaking the hoisting rope and dropping the hook block to the ground, often with fatal results.

The idea of this spring type hook block, shown on Figure 1, is to supplement the use of the normal limit switch, so that in case of its failure the

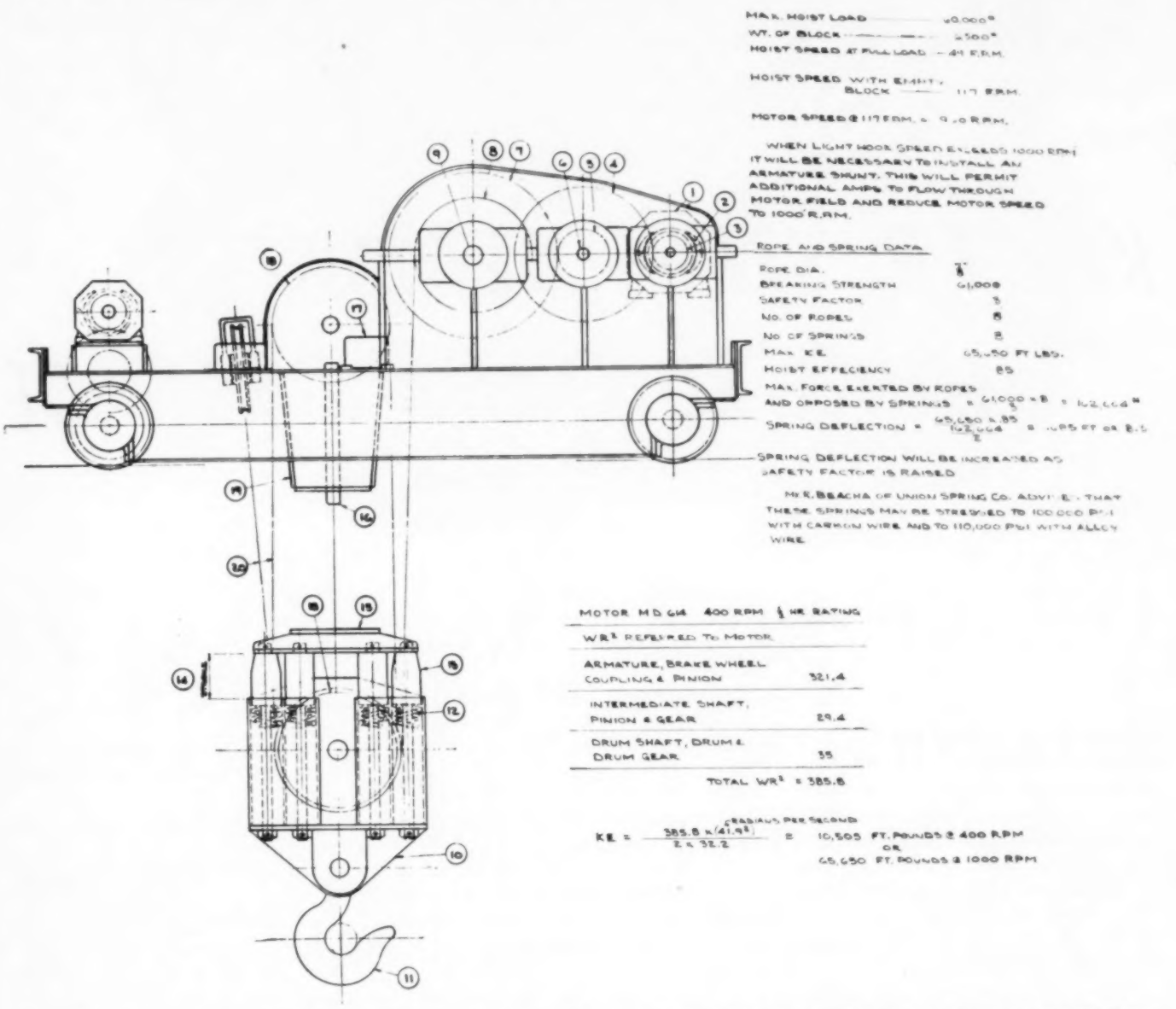

MAX. HOIST LOAD ..... 60,000#
WT. OF BLOCK ..... 4500#
HOIST SPEED AT FULL LOAD ... 41 F.P.M.
HOIST SPEED WITH EMPTY BLOCK ..... 117 R.P.M.
MOTOR SPEED @ 117 R.P.M. = 900 R.P.M.
WHEN LIGHT HOOK SPEED EXCEEDS 1000 R.P.M. IT WILL BE NECESSARY TO INSTALL AN ARMATURE SHUNT. THIS WILL PERMIT ADDITIONAL AMPS TO FLOW THROUGH MOTOR FIELD AND REDUCE MOTOR SPEED TO 1000 R.P.M.
ROPE AND SPRING DATA
ROPE DIA. 1/2
BREAKING STRENGTH 61,000
SAFETY FACTOR 3
NO. OF ROPES 8
NO. OF SPRINGS 8
MAX. K.E. 65,650 FT. LBS.
HOIST EFFECIENCY 85
MAX. FORCE EXERTED BY ROPES AND OPPOSED BY SPRINGS = 61000 x 8 / 3 = 162,666#
SPRING DEFLECTION = 65,650 x 85 / 162,666 / 2 = .425 FT OR 5.1
SPRING DEFLECTION WILL BE INCREASED AS SAFETY FACTOR IS RAISED
MR. R. BEACHA OF UNION SPRING CO. ADVISES THAT THESE SPRINGS MAY BE STRESSED TO 100,000 P.S.I. WITH CARBON WIRE AND TO 110,000 P.S.I. WITH ALLOY WIRE
MOTOR MD 614 400 RPM ½ HR RATING
WR² REFERRED TO MOTOR
ARMATURE, BRAKE WHEEL COUPLING & PINION 321.4
INTERMEDIATE SHAFT, PINION & GEAR 29.4
DRUM SHAFT, DRUM & DRUM GEAR 35
TOTAL WR² = 385.8
KE = 385.8 x (41.9)² (RADIANS PER SECOND) / 2 x 32.2 = 10,505 FT. POUNDS @ 400 RPM
OR
65,650 FT. POUNDS @ 1000 RPM

Figure 1 — Schematic sketch shows details of load absorption mechanism. Design calculations are shown on the drawing.

stored energy of the revolving parts of the hoist can be absorbed and the hook block brought to a stop without breaking the hoisting ropes.

The springs shown on the hook block could just as easily be located in the lifting beam. One reason, however, for installing these springs on the hook block is that on existing cranes, this safety feature could be added with the least amount of expense. Successful operation will occur as long as absorption of the kinetic energy of the hoist mechanism takes place regardless of where the springs are located in the hoisting mechanism.

The objection to most safety devices as applied to hoist mechanisms is the fact that they require a considerable amount of room in which to function and this results in reducing the effective maximum lift of the hoist. With this safety hook block, the maximum lift can be obtained when the springs on the hook block are fully compressed. Under these conditions the striker plate on top of the hook block is bearing against the bottom of the upper lifting beam. Since this striker plate is only 2 or 3 inches thick, the hoist can be raised to within 2 or 3 inches of the maximum height with safety.

This spring hook block will function when the standard limit switch fails to work.

KAISER STEEL DEDICATES THIRD FONTANA FURNACE

▲ THE Pacific Coast's third pig iron producing blast furnace was officially dedicated recently at Kaiser Steel Corp.'s Fontana plant. Identical to the other two blast furnaces at Fontana, the new blast furnace increases the West Coast's pig iron capacity by 50 per cent and completes the major portion of Kaiser Steel's current $65,000,000 expansion program.

The new blast furnace is the major unit of Kaiser Steel's $65,000,000 expansion program started 14 months ago. It has a rated capacity of 438,000 tons of pig iron per year, bringing the total rated capacity of the plant to 1,314,000 tons of pig iron annually. The new blast furnace will provide additional pig iron (as hot metal) for use by the open hearths, thereby eliminating dependence on outside sources of scrap iron, which at times have been critically short. Further, the additional pig iron will be available for sale to western foundries and other consumers, who in recent years have felt the pinch of pig iron shortages.

Included in the $65,000,000 expansion program are the following major facilities:

1. A ninth open hearth furnace, which started operations in January of 1953, increasing the annual rated capacity of the plant to 1,536,000 ingot tons.

2. Ninety new coke ovens, with a capacity to produce 410,000 tons of coke per year to supply additional fuel for the blast furnaces. This additional bank of ovens eliminates the need for outside purchases of coke and will augment the supply of by-products.

3. Two new stands of rolls are being added to the present four-stand hot strip mill to enable it to roll sheet in thinner gauges, thus opening up new markets. Present schedules indicate these rolls will be in operation by October of this year.

4. Various modifications and enlargements to the blooming mill have been made to increase its rolling capacity.

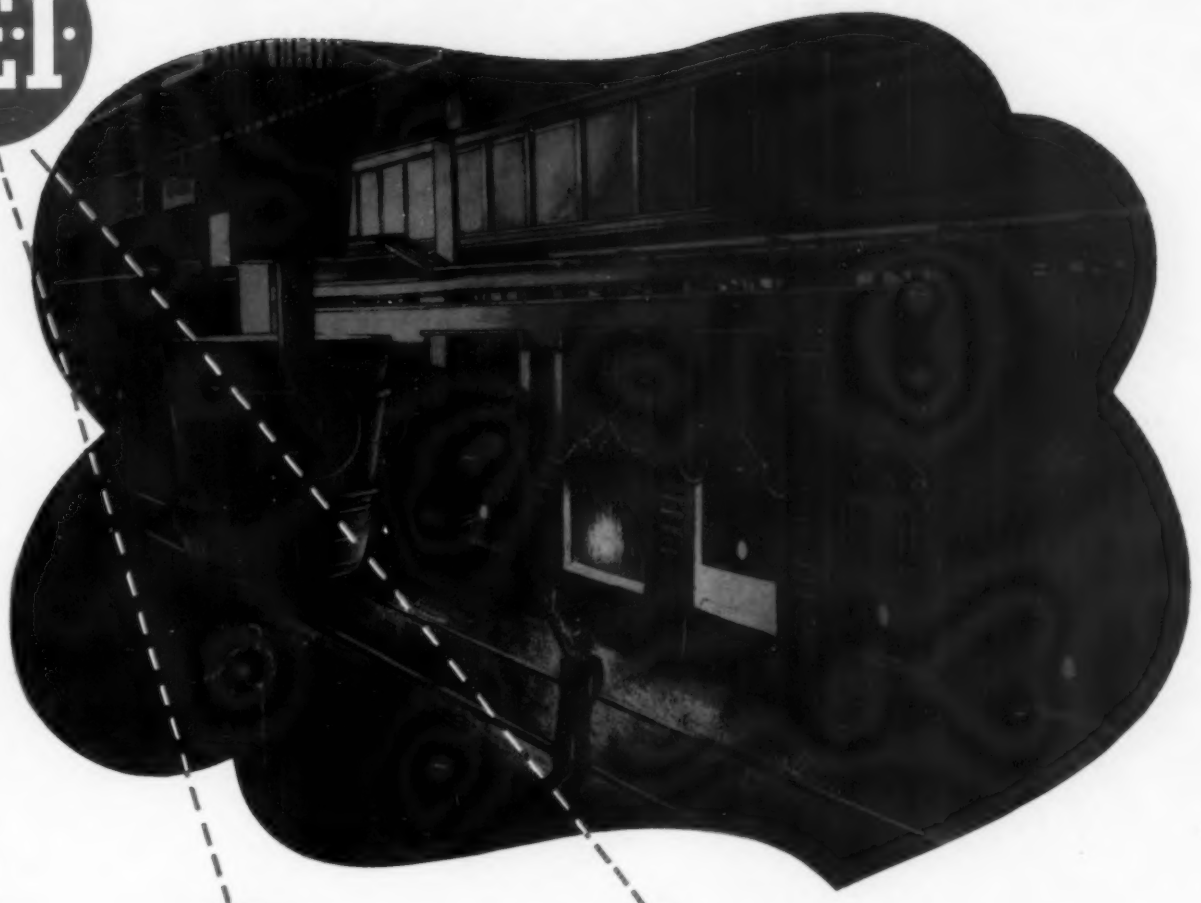
5. Four new soaking pits have been added, making a total of 22. In these pits, ingots are heated to the proper temperature for rolling.

6. The sintering plant, where ore fines and coke breeze are agglomerated to provide additional charging material for the blast furnaces, has been enlarged.

7. To furnish the 50 per cent increase in iron ore and coal required by the new blast furnace and coke ovens, major expansion programs at the company's iron ore mine at Eagle Mountain, Calif., and the coking coal mines of Sunnyside, Utah, have been necessary. At both locations extensive additions to equipment, machinery, and housing have been undertaken.

Kaiser Steel employment has increased from 7,330 as of June 30, 1952, to 8,279 as of May 1, 1953.

F·E·I·



FOR ENGINEERING IMPROVEMENTS *in*

Open Hearth FURNACES

Complete...from Plan to Production

Furnace Engineers, Inc. provides the latest advancements in Open Hearth Furnaces that insure top performance. Our staff includes men with up to 30 years or more experience . . . specialists in the design, construction and operation of all types of industrial furnaces.

F.E.I. service is complete—from plan to operation—whether it is an entirely new installation or the modernization of existing furnaces.

Consult us without obligation

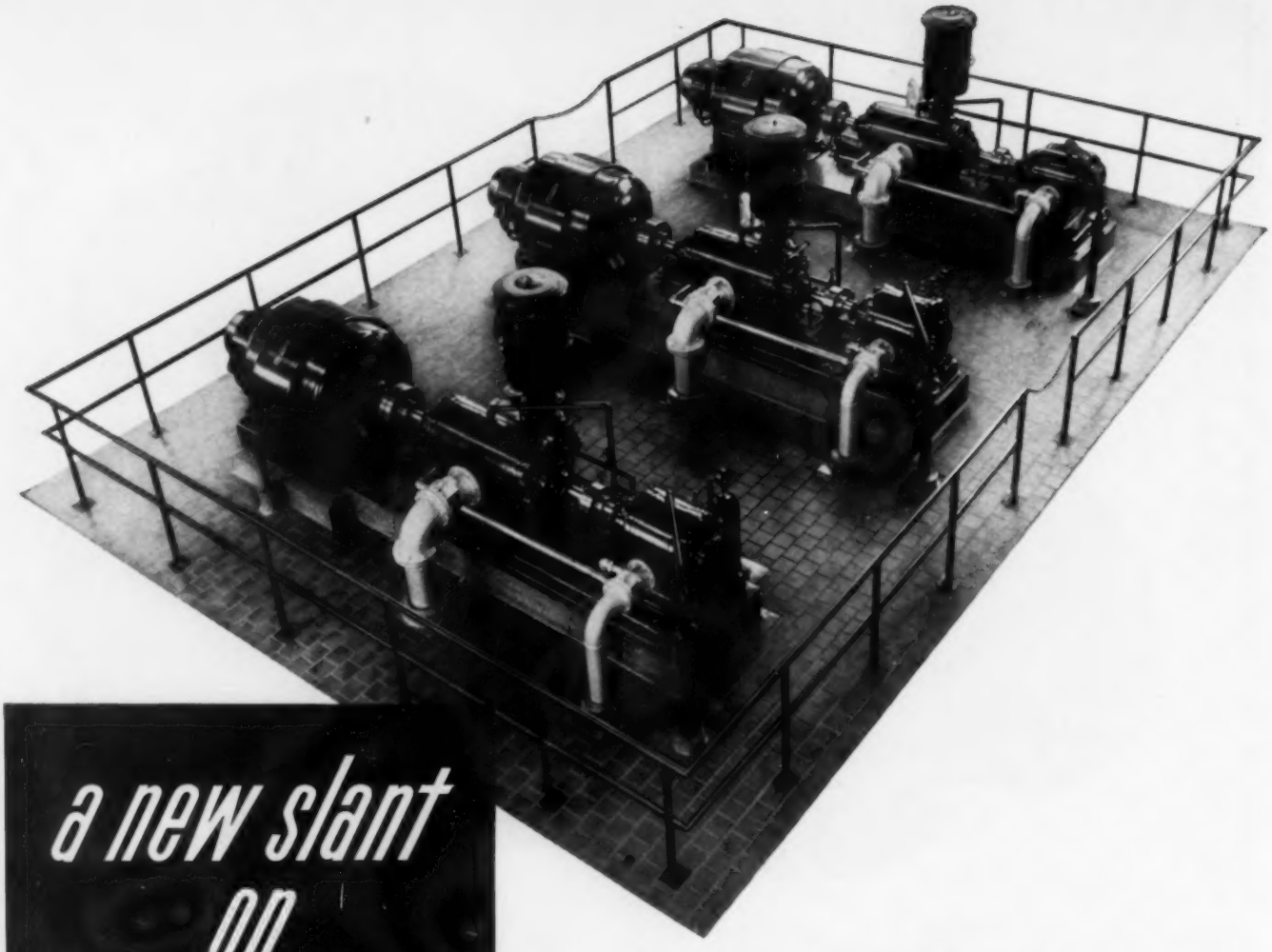
F. E. I. BUILDS

OPEN HEARTH FURNACES,
SOAKING PITS—*regenerative and one-way recuperative,*
CONTINUOUS REHEATING FURNACES *for slabs, billets and blooms,*
FORGING FURNACES,
ANNEALING and NORMALIZING *Furnaces for gun tubes, shells, bombs and armor plate,*
DIRECT FIRED BELL TYPE ANNEALING FURNACES *for coils, sheets and wire,*
GALVANIZING FURNACES *for tubes, sheets, metalware and jobbing,*
OTHER COMPLETE HEATING LINES

F·E·I· FURNACE ENGINEERS, INC.

Affiliated with BRASSERT CORPORATION, NILES CONSTRUCTION CO. and STANDARD BOILER & PLATE IRON CO.

General Offices: **UNION BANK BUILDING, PITTSBURGH, PA.**



a new slant on compressors

***simple *compact *direct drive**
***valveless *vibrationless *pulseless**

If you've never considered the advantages of Fuller Rotary Compressors and Vacuum Pumps, now is the time to do so.

Fuller Rotaries have many unique and beneficial advantages for you. For instance, they can be placed almost anywhere out of the way, because their vibrationless, rotary action permits, for example, balcony installation. Because they operate by direct drive, you eliminate the initial and maintenance costs, as well as transmission losses incident to gear and belt drives. Maintenance costs are kept to a minimum.

Because Fuller Rotaries compress without reciprocating pistons, you get a non-pulsating air stream. They are extremely compact for the volume delivered; sizes to deliver up to 3300 cfm. free air, for pressures from atmosphere to 125 psig. Write today to the Fuller Company, Catasauqua, Pa. for literature and engineering data.

Fuller

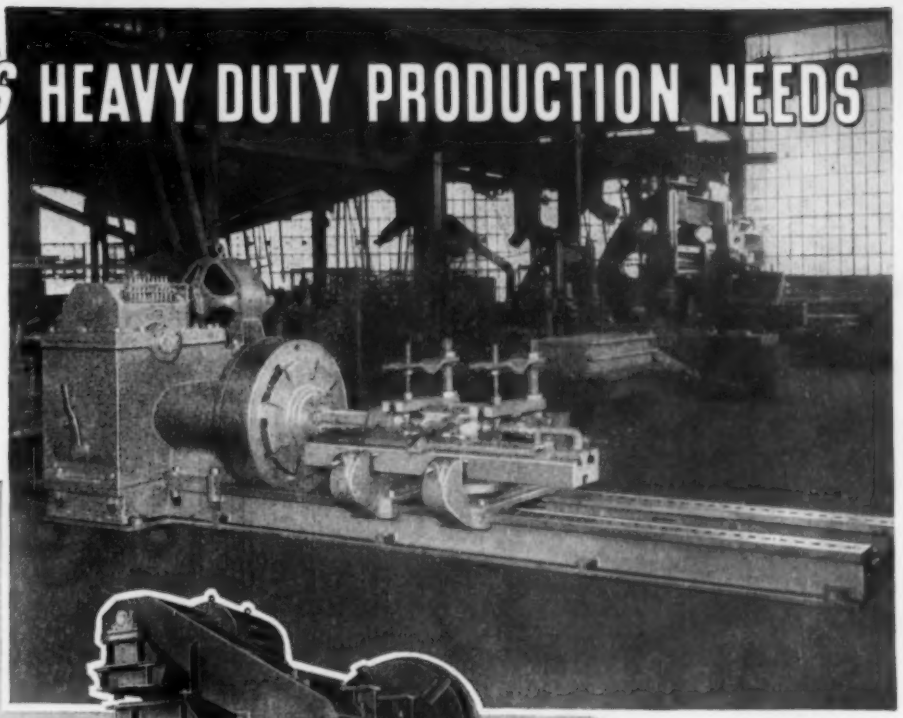
FULLER COMPANY
Catasauqua, Pa.

Pioneers of high efficiency vane-type rotary compressors

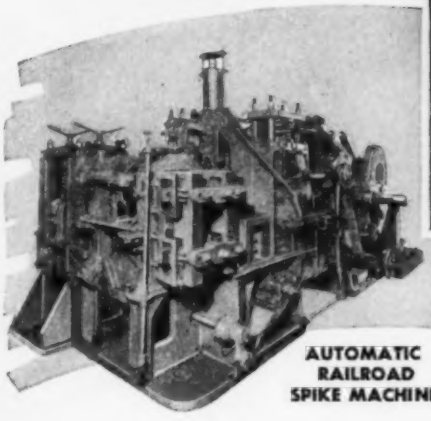
Branch Offices: Chicago • San Francisco • Los Angeles • Seattle • Birmingham

C-230
1862

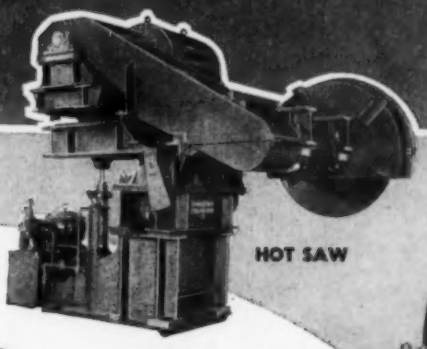
SERVING *TODAY'S* HEAVY DUTY PRODUCTION NEEDS



18" WORM DRIVE ROLL LATHE



AUTOMATIC RAILROAD SPIKE MACHINE



HOT SAW

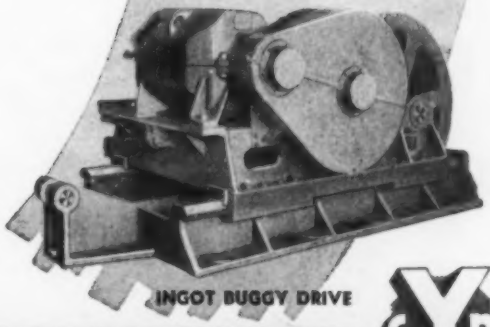
Check this List for the Products You Need

PARALLOY ROLLS (Pinch, Coiler, Tension, Steel Mill)
HYDRAULIC SLAB AND BILLET PILERS
STRIP AND SHEET OILING EQUIPMENT
SHEET SCRUBBER AND CLEANING LINES
HOT SAWS—ROCKING AND SLIDE TYPES
HOT BEDS—COOLING BEDS—TRANSFERS
BILLET EJECTORS—PINCH ROLL STANDS
SLITTERS—SPECIAL SHEARS AND GAUGES
TILTING TABLES—Traveling and Lifting Tables
Continuous PICKLING Lines—ROLLER LEVELERS
FURNACE Charging Equipment—Furnace Pushers
Strip Steel COILERS and REELS—SCRAP BALLERS
RAILROAD Spike Forming Machines—ROLL LATHES
Sheet GALVANIZING Lines—Wire Patenting Frames
Stretcher Levelers—Angle and Shape Straighteners
Rolling Mill Tables—Gear and Individual Motor Types
DUCTILE CASTINGS (80,000 PSI.)

Machinery Built to Customer's Design and Detail Drawings

WELDED GEAR REDUCER

SCRUBBER and CLEANING LINE

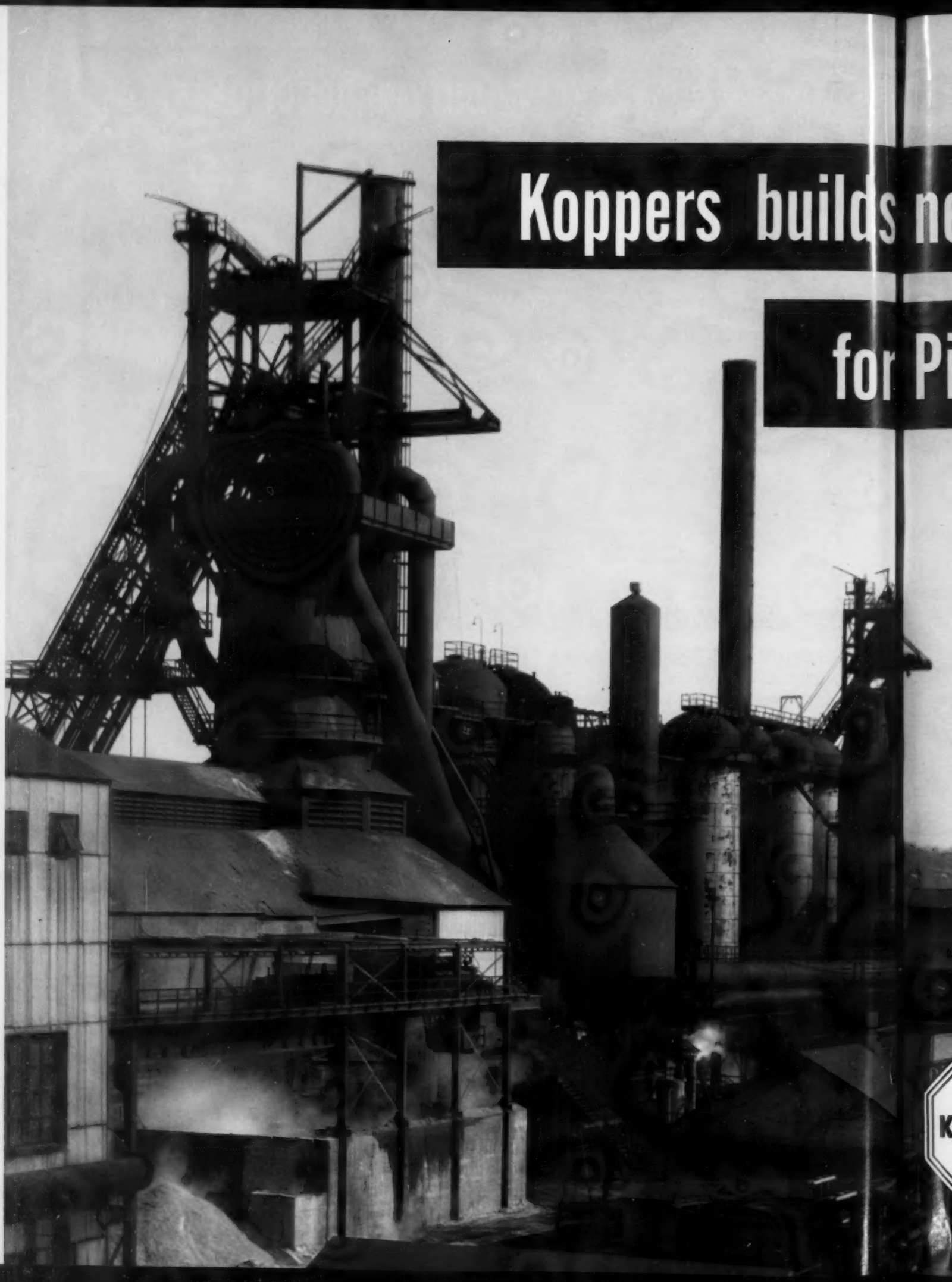


INGOT BUGGY DRIVE

The Youngstown Foundry & Machine Co.

OVER SIXTY YEARS OF SERVICE TO THE STEEL INDUSTRY

Youngstown, Ohio


Koppers builds n
for Pi

s new blast furnace

r Pittsburgh Coke & Chemical

THIS new blast furnace was recently constructed by our Freyn Department for the Pittsburgh Coke & Chemical Company. It has a hearth diameter of 22 feet; a total height, from iron notch to top ring, of 93 feet, 9 inches. Rated capacity is 850 tons of merchant iron per day.

Incorporated in this furnace are the most modern controls and equipment—all of Freyn-Design. Some of these noteworthy features are: automatic charging control . . . coke screening . . . pneumatic bell hoists . . . electric skip hoist . . . stockline recorder . . . hot blast temperature control . . . top pressure equalizer . . . excess gas burner-bleeder . . . stove pressure burners . . . gas washer and cyclone moisture eliminator.

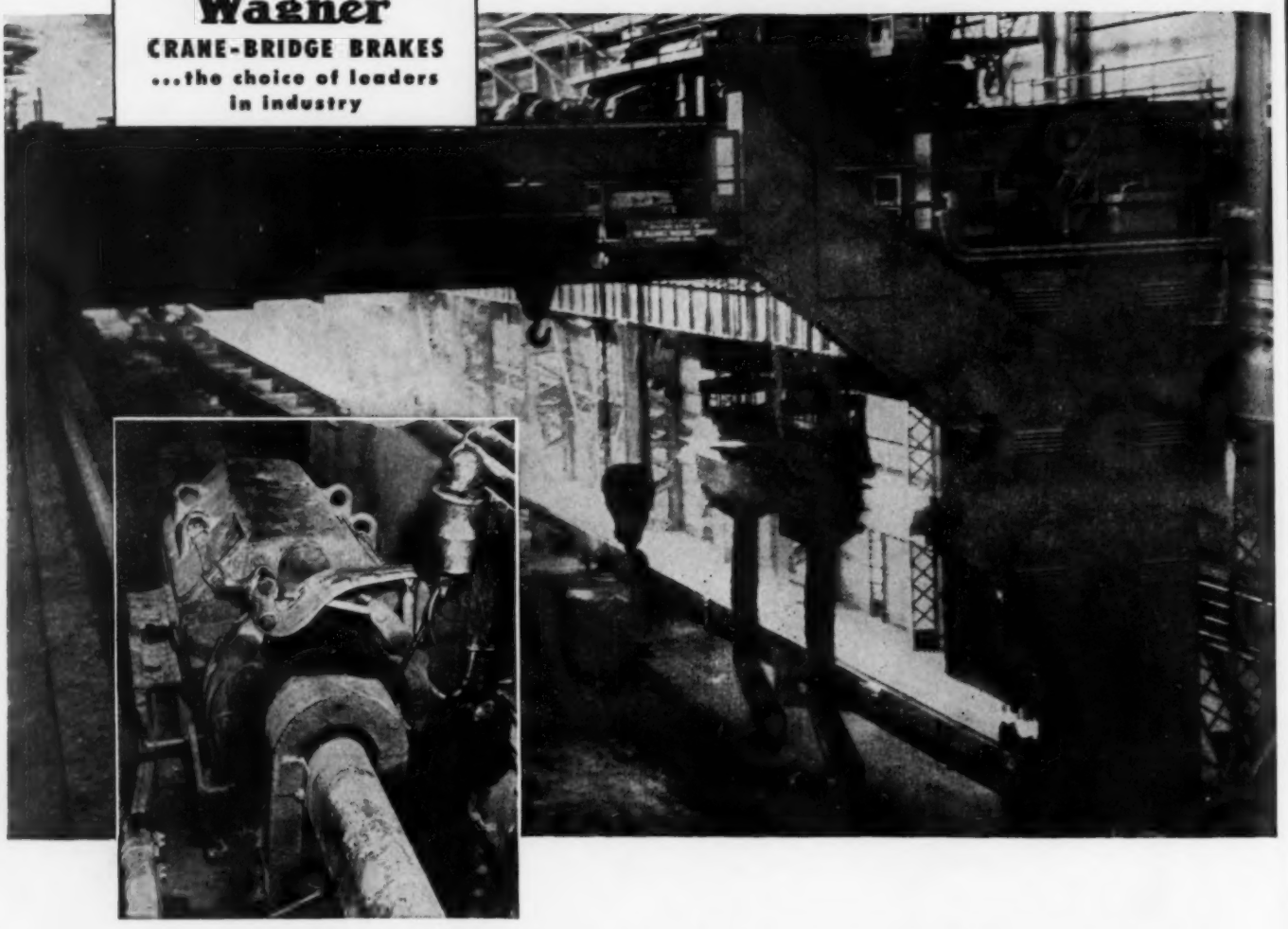
Constructing blast furnaces is just one way in which Koppers serves industry. For any kind of metallurgical construction, you can count on Koppers. You are invited to consult with our Engineers and Management.

KOPPERS®

Engineering and Construction Division

KOPPERS COMPANY, INC., PITTSBURGH 19, PENNSYLVANIA

Wagner
CRANE-BRIDGE BRAKES
...the choice of leaders in industry



Wagner *POWERED* Hydraulic Crane Bridge Braking

Lengthens life of crane bridge reductions and brakes
...Reduces physical strain on operators...

At the U. S. Steel Corporation's Homestead Works No. 5 Open Hearth, a 300 ton ladle crane was equipped with a Wagner *Powered* Hydraulic Bridge Brake System a little over a year ago.

This system solves the problem of moving a ladle of metal from mold to mold, a distance of 54 inches, with great accuracy and with smooth stops to minimize the swing of the ladle.

The tip toe button operation of this new system has greatly reduced arm and leg strain for the crane operators. Mechanical wear on the crane bridge reductions and brakes has been reduced, and the life of the brake shoe lining has been lengthened from six weeks to four months—nearly triple!

Wagner powered units can be added to your present Wagner Hydraulic Bridge Brake System. Investigate this new method of braking today—write for Bulletin IU-36 which fully explains and describes Wagner Powered Hydraulic Braking.

Replacement Lining and Brake Wheels

Wagner offers the perfect combination of brake wheel and non-scoring lining for replacement needs. Wagner Brake Lining is specially designed and manufactured to meet the exacting service requirements of industrial braking. It is available in rolls, blocks, and discs.

WAGNER ELECTRIC CORPORATION
6483 Plymouth Ave., St. Louis 14, Mo., U.S.A.

®Wagner Electric Corporation EST. WE 1891

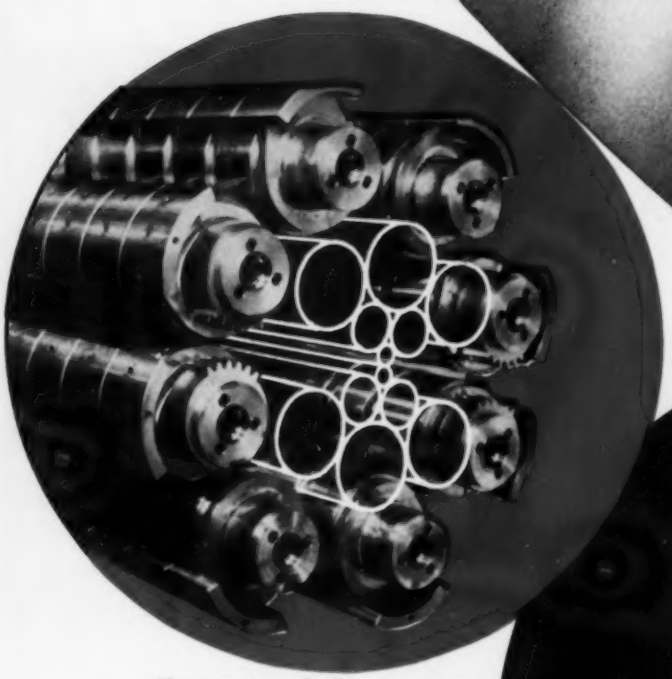
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

153-1

This 80" SENDZIMIR MILL

maintains precise gauge across the width and along length of strip



Phantom view of roll arrangement

This Sendzimir cold strip mill rolls 80" wide low carbon steel from hot rolled thickness to .024" with total gauge variation of .0004". Similar uniformity is being regularly obtained on Sendzimir cold strip mills rolling brass, copper, aluminum, stainless steel, silicon steel, etc.

CONSIDER THE ADVANTAGES OF THE SENDZIMIR COLD MILL

- Extreme Accuracy In Gauge, Due To Uniform Support Throughout Mill
- Elimination Of Intermediate Anneals
- Greater Reductions Per Pass
- Highest Surface Finish
- Quick And Simple Roll Changes
- Low Initial And Maintenance Costs

SENDZIMIR MILLS

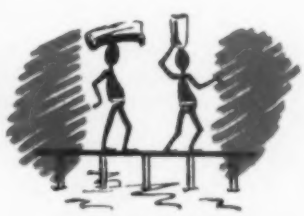
ARE ENGINEERED BY

ARMZEN CO.

SALES & ENGINEERING AT WATERBURY 12, CONN. TEL. 6-4617

FOREIGN: SENDZIMIR LTD., 75 Grosvenor St., London W1, England
PROCÉDÉS SENDZIMIR S. A. R. L. 57 Rue Ampère, Paris 17, France

Backing Roll Support



Sendzimir Support

ALSO SENDZIMIR COLD SHEET MILLS—SENDZIMIR PLANETARY HOT STRIP MILLS

AR-4

BLAST FURNACE STOVE CLEANED IN TWO DAYS

Heating efficiency increased 30% by Dowell Chemical Cleaning

Flue deposits that accumulate on the checkerworks of blast furnace stoves need not halt iron production! Stoves with heavy deposits have been cleaned in two days by Dowell—while the other stoves carried the heating load to avoid shutdown.

To clean their stoves, *and keep them clean*, many operators rely on Dowell chemical cleaning service. That's because Dowell's record for service work of this kind is outstanding in the industry. On one job, for instance, chemical cleaning by Dowell helped raise the gas heating efficiency of a blast furnace stove from 63.6% to 82.7%. What's more, the cleaning was accomplished *in two working days without dismantling the stove!* Dowell Service engineers used a high-pressure solvent jet, which combines chemical and hydraulic action to clean the brick checkerworks.

Dowell engineers are experts in cleaning industrial equipment with solvents. Almost every piece of equipment found in a blast furnace gas cycle has been cleaned by Dowell . . . some while in operation.

Whatever your problem, look to Dowell chemical cleaning service for the practical answer. For complete information, call your nearest Dowell office. Or write directly to Tulsa, Dept. G-29.

DOWELL SERVICE

Over 100 Offices to Serve You with Chemical Cleaning for:

Boilers • Condensers • Heat Exchangers • Cooling Systems
Pipe Lines • Piping Systems • Gas Washers • Process Towers
Process Equipment • Evaporators • Filter Beds • Tanks

Chemical Services for Oil, Gas and Water Wells

DOWELL INCORPORATED • TULSA 1, OKLAHOMA

DOWELL

A Service Subsidiary of
THE DOW CHEMICAL COMPANY

Date-line Diary...

June 1

▲ EEI reports that the electric utility industry plans to spend $12,000,000,000 by the end of 1956 to boost generating capacity to 125,400,000 kw from present 81,400,000 kw.

▲ The Federal Reserve Board announced that consumer credit rose $501,000,000 in April thus reaching a new high of $26,200,000,000 or $5,200,000,000 above the mark in 1952.

▲ The AISI reports that operating rate of the steel industry for the coming week is scheduled at 100.3 per cent of capacity. This is equivalent to 2,262,000 tons and the same as last week.

June 3

▲ National Steel Corp. reported an indefinite shutdown of its Weirton Mine near Morgantown, W. Va. which began operations only 3½ years ago.

▲ According to The Aluminum Association, aluminum production for April totaled 204,142,768 lb compared with 208,919,425 lb in March. This is a 33 per cent increase over April 1952.

June 5

▲ Both the U. S. Chamber of Commerce and NAM continued to refuse an endorsement of the president's proposal to extend excess profits tax.

June 8

▲ The AISI reports that operating rate of the steel industry for the coming week is scheduled at 99.9 per cent of capacity. This is equivalent to 2,252,000 tons compared with 2,246,000 tons one week ago.

June 9

▲ Schuman Plan High Authority ordered German and Italian scrap iron cartels to cease activity by June 14.

June 10

▲ A $7,757,865 clad metal plant was placed in operation by Superior Steel Corp. at Carnegie, Pa.

▲ A survey by the Commerce Department and Securities and Exchange Commission indicates that expenditures for plants and equipment may reach $28,000,000,000 for 1953.

▲ Corporation stockholders received $2,700,000,000 in dividends for the first five months of 1953 which is 3½ per cent over the same period in 1952.

June 11

▲ Despite a slow start, Great Lakes ore fleet has passed the previous year's figure of 19,152,694 tons by transporting 22,468,520 tons over the first five months period.

▲ Michigan Limestone Division of U. S. Steel Corp. set a new high for its production of limestone by shipping out 2,157,000 tons in May from its plant at Rogers City, Mich.

▲ At Bethlehem Steel Co.'s West Coast plants, production topped March's high of 86,384 tons with a high of 87,265 tons in May.

▲ According to American Railway Car Institute, May deliveries of new domestic freight cars totaled 6582 compared with 6857 in May 1952, leaving a backlog on June 1 of 57,345.

June 12

▲ Lead increased ¼¢ to 13½¢ a lb in New York, and 13.3¢ in St. Louis.

▲ U. S. Steel Corp. and United Steelworkers of America agreed upon an 8½¢ hr wage increase which will be applied uniformly to each of the 32 job class rates now in effect. The lowest wage becomes $1.52 per hr.

June 13

▲ Following a month of negotiations, Weirton Steel Co.'s president Thomas E. Millsop announced an 8½¢ hr wage increase which brings the minimum wage at Weirton to $1.62½ per hr.

▲ The Electro Metallurgical Co., a Division of Union Carbide and Carbon Corp., announced a new base price of 13.15¢ per lb of contained manganese.

June 15

▲ AISI reports that operating rate for the steel industry for the coming week is scheduled at 98.7 per cent of capacity. This is equivalent to 2,226,000 tons compared with 2,208,000 tons one week ago.

June 16

▲ Justice Department won a consent judgment on anti-trust charges against Republic Steel Corp. and a group of corrugated culvert manufacturers.

▲ According to the AISI, April shipments of steel totaled 7,162,460 net tons, second only to March with 7,436,919 tons.

▲ U. S. Steel Corp. announced an over-all advance of approximately 1/5¢ per lb for carbon steel products with proportionate increases for alloy and stainless steel products.

▲ The F. W. Dodge Corp. reports that construction in the 37 states east of the Rockies continued upward toward a new high for the first five months of 1953 of $6,792,329,000 which is an 8 per cent increase over the same period for 1952. Construction total for May was $1,606,091,000 or 8 per cent lower than April but 3 per cent over May 1952.

June 17

▲ Inland Steel Co. upped its prices of steel mill products approximately $3.60 per ton as a result of the recent wage boosts granted employees of the company.

June 18

▲ Colorado Fuel & Iron Corp. recently installed a Petit-process char plant at its Pueblo, Colorado works. The retort recovers 1600 lb of char per ton of coal per hr.

▲ In line with the pattern set by U. S. Steel Corp., steel prices were boosted an average of about $4 a ton by Bethlehem, Republic, Jones and Laughlin, Inland, and Youngstown Steel companies.

▲ Parcel post zone increase of 36 per cent will go into effect around August 1.

▲ The nation's three leading aluminum producers, Alcoa, Reynolds Metals, and Kaiser Aluminum will distribute 90,000,000 lb of aluminum in the third quarter to independent fabricators.

▲ Independent Iron Works, Inc., Oakland, Calif. has filed suit against U. S. Steel Corp. and Bethlehem Steel Corp. charging that the two steel firms had violated the Sherman Anti-Trust Act, the Defense Production Act of 1950, and the Clayton Act.

▲ U. S. Steel Corp. will shut down operations permanently at its Bridgeville, Pa. mine by the end of June. Coal is exhausted.

June 19

▲ As directed by the Defense Department, the Air Force canceled contracts for seven of the seventeen heavy hydraulic presses it had scheduled for the next two years.

▲ The Export-Import Bank will loan $22,400,000 to Rhodesia Congo Border Power Corp. to enable them to supply copper and cobalt to the United States, two limited items on our markets today.

▲ H. H. Tullis, Vice President, Armco Steel Corp., predicted U. S. Steel capacity would increase to 140,000,000 tons by 1960 and that his company would expand 1,000,000 tons in the next 5 years.

▲ A number of refractory companies granted an 8½¢ hourly wage increase as of July 1. This is in accordance with settlements reached by the firebrick producers and the United Construction Workers.

June 20

▲ The Lake Superior Iron Ore Association reported iron ore consumption advanced to a new high for May with a record of 8,358,260 gross tons. Consumption for May 1952 was 6,949,839 tons.

▲ Edward F. Howrey, chairman FTC, in a letter to Congress indicated that freight absorption has FTC blessing.

▲ Parcel post rates to foreign countries will be advanced on August 1, the first hike since 1934.

June 22

▲ AISI reports that operating rate for the coming week for the steel industry is scheduled at 99.1 per cent of capacity. This is equivalent to 2,235,000 tons compared with 2,183,000 tons one week ago.

▲ Republic Steel Corp. opened a new seamless tube mill in South Chicago, Ill.

▲ Koppers Co. has contracted to design and construct a new battery of 79 chemical-recovery coke ovens for Jones & Laughlin Steel Corp.'s Hazlewood plant, Pittsburgh, Pa. This will carbonize 1,925 net tons of coal daily as compared to the old battery of 50 ovens to be replaced which carbonized 850 net tons daily.

▲ Republic Steel Corp. of Cleveland, Ohio purchased for $1,992,000 a tin plating plant located at Niles, Ohio from the RFC. This plant has been operated by Republic for the past ten years.

June 24

▲ Harrisburg Steel Corp.'s stockholders will be asked to approve a 2 to 1 split of common stock and a cut in par value from $5 to $2.50 a share.

▲ Republic Steel Corp. is the first manufacturer to officially enter into the plastic pipe field by its purchase of Owings-Sharpe, Inc., of Magnolia, Ark. which produces plastic tubing ranging from ½ to 6⅝ in. in diameter.

▲ Cleveland-Cliffs Iron Co. boosted iron ore 15¢ a ton, effective July 1.

▲ United States Steel Products Div. announced price increases ranging from 6½ to 8 per cent on its line of steel drums and pails.

June 25

▲ Dominion Foundries & Steel Ltd., Hamilton, Ontario, Canada, confirmed reports that it has purchased all Canadian rights to the Brassert process of producing steel from molten iron by using high purity oxygen. Operating costs are reported to be reduced ¼ over standard open hearth methods.

▲ The AISC reported May bookings of fabricated structural steel of 306,319 tons, the highest figure for the last 25 months. Shipments totaled 265,000 tons. Backlog of work ahead as of May 31 stands at 2,178,-918 tons.

June 27

▲ Major railroads requested a 45 per cent increase in mail pay from the Interstate Commerce Commission. This would add $143,000,000 annually to Government's railroad costs.

▲ Interlake Iron Co., a leading producer of merchant pig iron, raised its prices to $56.50 a ton, up $1.50.

June 29

▲ Sharon Steel Corp. plans to idle most of its plant for two weeks vacation instead of staggering vacations. This is a new precedent in the steel industry.

▲ AISI reports that the operating rate for the steel industry for the week beginning June 29 is scheduled at 96.1 per cent of capacity. This is equivalent to 2,166,000 tons compared with 2,183,000 tons one week ago.

▲ U. S. Steel Corp. announced price increases for pig iron effective June 30 of about 3 per cent. Price of basic pig will now be $56 per gross ton.

▲ Crucible Steel Co. announced an increase of $1.50 per ton on all grades of pig iron effective July 1.

June 30

▲ Commerce Dept. announced that NPA will continue operations on a reduced scale through July 31. It had originally been scheduled to end today.

▲ CIO United Steelworkers increased net worth to $10,855,697 at the end of 1952. Claimed membership was 1,100,000 or the same as 6 months before.

▲ Office of Defense Mobilization established expansion control for wide flange structural steel shapes of 2,850,000 tons by July 1, 1955. This is an increase of 850,000 tons over 2,000,000 tons produced in 1950.

26″ STRUCTURAL MILL

BUILT BY MORGAN Engineering

DESIGNERS • MANUFACTURERS • CONTRACTORS

BLOOMING MILLS • PLATE MILLS • STRUCTURAL MILLS

ELECTRIC TRAVELING CRANES • CHARGING MACHINES

INGOT STRIPPING MACHINES • SOAKING PIT CRANES

ELECTRIC WELDED FABRICATION • LADLE CRANES

STEAM HAMMERS • STEAM HYDRAULIC FORGING PRESSES

SPECIAL MACHINERY FOR STEEL MILLS

THE MORGAN ENGINEERING CO.

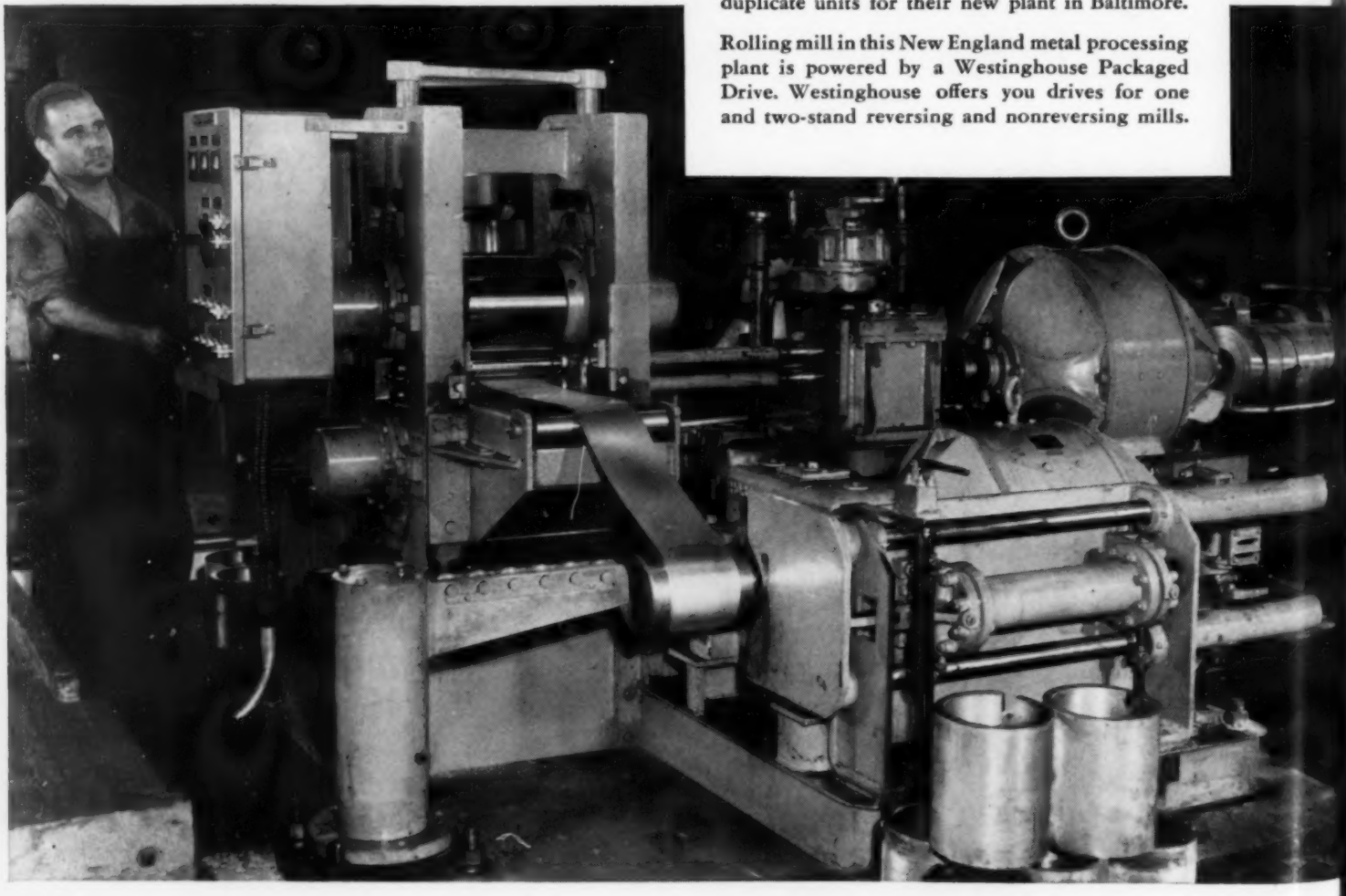
ALLIANCE, OHIO PITTSBURGH—1420 OLIVER BUILDING

Illustrated is a 26″ Three-High Structural Mill, consisting of one 26″ Three-High Pinion Stand connected to two Three-High Roll Stands and one Two-High Pinion Stand connected to one Two-High Finishing Stand.

For serving this mill, there was furnished four Traveling and Tilting Tables and four Traveling Trailing Tables.

Your inquiries for mill equipment will be appreciated.

Another customer, Thompson Wire Company, Franklin Park, Illinois, uses four Westinghouse Bell Furnaces on 12 bases. New operation gives Thompson greater load per heat and lower maintenance costs. Success persuaded Thompson to order duplicate units for their new plant in Baltimore.



Rolling mill in this New England metal processing plant is powered by a Westinghouse Packaged Drive. Westinghouse offers you drives for one and two-stand reversing and nonreversing mills.

Westinghouse furnaces and drives help you reheat and roll your own

Many fabricators of steel, brass and aluminum products are learning that processing metals to their own specifications is practical and profitable. Ahead of the trend, Westinghouse engineers have developed both electric and gas-fired, bell-type furnaces for reheating and packaged drives to run small rolling mills. Here's a report from one customer . . .

Three-base hit

A Westinghouse Bell Furnace bright-anneals low carbon steel, for Venetian blinds at Rodney Metals, Inc., New Bedford, Mass. The three-base installation operates nonstop. While one batch of steel (two coils, each 24½ inches wide and weighing two tons) anneals under the bell, another batch cools under the hood on base No. 2, and another is loaded or unloaded on base No. 3. "Maintenance," says Frank L. Morse, Rodney's chief engineer, "is practically nil."

Steady heat

"We use sheet steel in gauges from .002 to .060, annealed and scale-free to save cleaning before our plating and painting steps," says Mr. Morse. "That means constant atmosphere and temperature control. Westinghouse Exogas® generating and regulating equipment, installed with our new bell furnace, fills the bill 100%."

Working for yourself

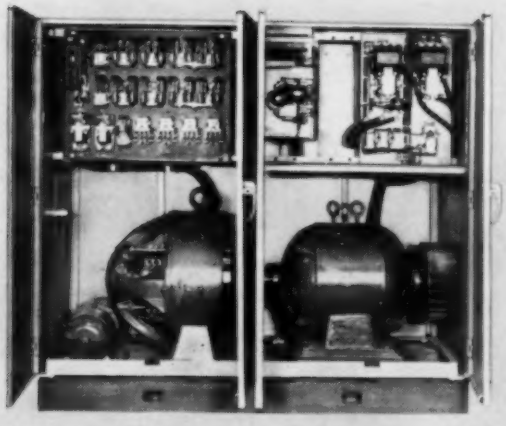
Mr. Morse sums up the advantages of doing your own annealing and rolling. "We get a better price on steel coils, based on volume. We carry a smaller, concentrated inventory. We reduce and anneal to *our* specifications—without waiting for outside suppliers. We avoid down time because, with a Westinghouse integrated operation, our own warehouse can supply any gauge or hardness to our production line!"

Let Westinghouse help

Westinghouse engineers can plan and install a packaged drive and heat-treating furnace in your plant. For more information, simply phone your nearby Westinghouse representative. Westinghouse Electric Corporation, Pittsburgh 30, Pa. J-94001

YOU CAN BE SURE...IF IT'S

Westinghouse



Packaged drives, in neat, compact cabinets, are easy to install and operate. At left: exciter and d-c generator. At right: a-c motor.

Speeds plate levelling, slows gear and roll wear... *with 84 TIMKEN® bearings*

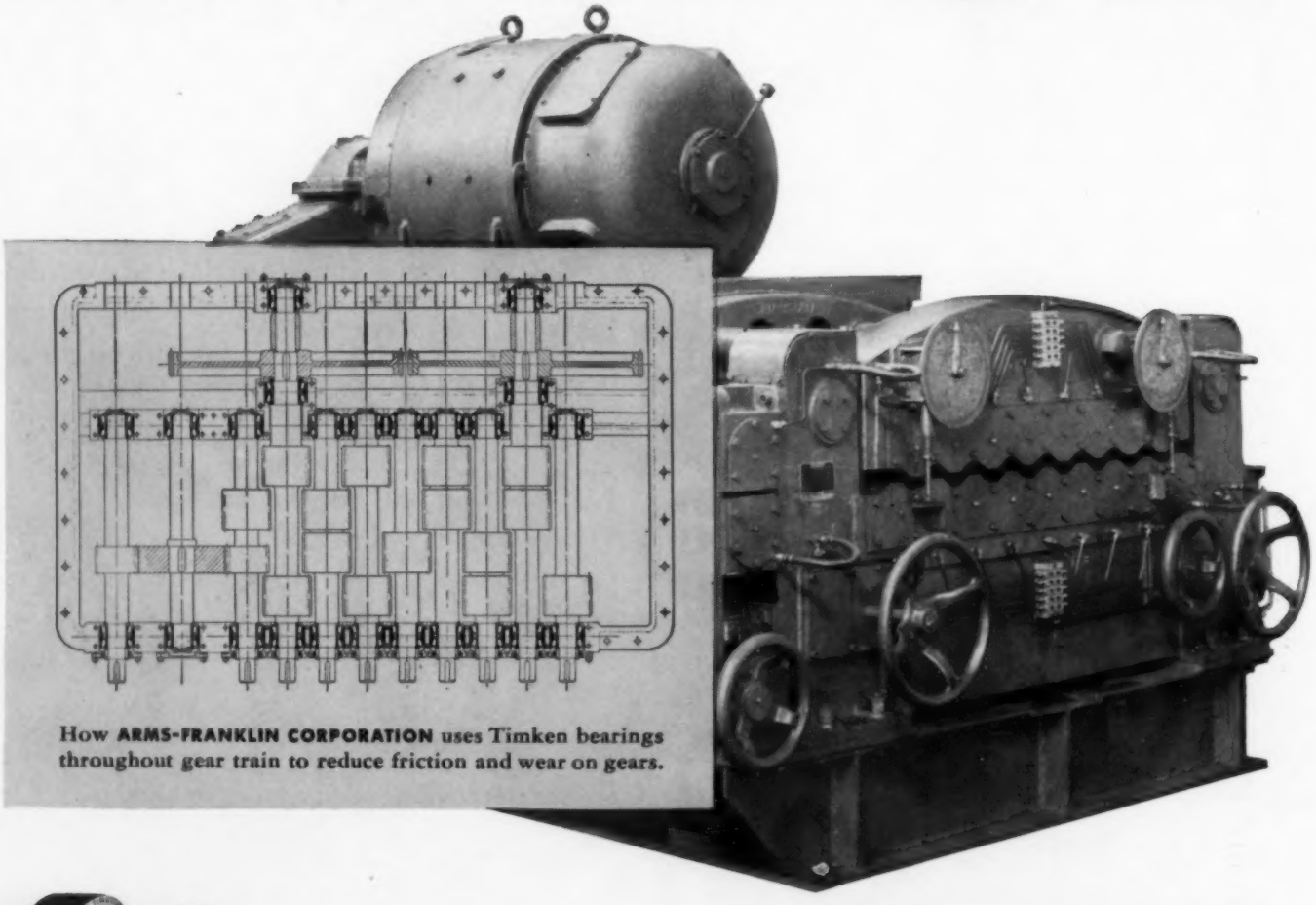
THIS Arms-Franklin Corporation leveller has power to spare for levelling ⅜-inch carbon and alloy plate. But a major design problem lay in delivering that power to the rolls, without leaving too much of it in bearings and gear train along the way.

One important part of the solution was mounting gears and rolls alike on Timken® bearings. This simplified design from the start, for Timken bearings' tapered rollers take both radial and thrust loads. Thus, special thrust bearings were eliminated. Bearing friction was held to a tight minimum, as a result of Timken bearings' true rolling motion and unbelievably smooth finish.

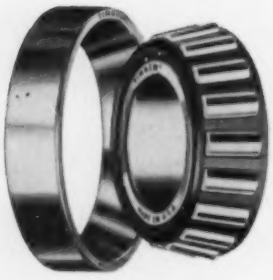
46 of the 84 Timken bearings in this leveller are used to hold the gears in precise alignment. Gears mesh accurately, smoothly, with less friction—and wear less as a result. And, since Timken bearings hold the rolls rigidly parallel, the plate passes through with little or no side slippage to cause roll wear.

With all this, line contact between rollers and races gives Timken bearings plenty of capacity for the buffeting shocks of tough levelling jobs. Whether you buy or build machines, specify Timken bearings. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



How **ARMS-FRANKLIN CORPORATION** uses Timken bearings throughout gear train to reduce friction and wear on gears.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

MAGNIFYING GLASS INSPECTION OF EVERY ROLLER!

Every one of the over one billion Timken bearing rollers produced every year is inspected with powerful magnifying glasses to detect surface flaws. It's just one example of how the Timken Company insures uniform high quality.

NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

Industry News...

REPUBLIC STEEL CORP. PERFECTS PROCESS FOR COMMERCIAL PRODUCTION OF IRON POWDER

▲ A new patented process for the production of powdered iron has been perfected by Republic Steel Corp. Republic will utilize the process for the commercial production of iron powder in a new plant, the erection of which will start soon in Toledo, Ohio.

The plant will have a capacity of 50,000 lb per day, a substantial part of the nation's present market for iron powder. It has been designed for expansion to keep pace with the expected growth in the market.

In entering the much-discussed field of iron powder, Republic becomes the first of the nation's major steel companies to set up for its production on a commercial scale.

About 100 companies in the United States use iron powder to form gears and similar precision mechanical parts by pressing the powder between dies under high pressure and subsequently heating the pressed part to temperatures at which the particles of iron weld themselves together forming a unified mass with a smooth surface usable without subsequent machining. This permits such parts to be mass produced quickly and economically.

Republic also proposes to make iron powder for application in the field of flame scarfing and cutting where substantial quantities are used to intensify the heat of the flame; and for which Republic has extensive use in its own steel plants.

Consideration is being given to the production, by a variation of the process, of sponge iron which might be used to produce tool steel and similar high grade steels. Experiments also show promise of producing nickel and manganese from low grade ores.

Samples of the Republic powder have been submitted to seven of the largest consumers in the country and all reported the powder to be of excellent quality.

Republic will build the iron powder plant on land recently acquired, near the Toledo refinery of Sun Oil Co. where facilities are being erected by Sun for producing high octane gasoline, to be completed in October. Hydrogen, necessary for the Republic process, will be a by-product of the process to be utilized by Sun. Republic will purchase such of this hydrogen as it requires.

Beside proximity to a source of hydrogen, the Toledo location is also well situated in relation to the automotive industry in Western Ohio and Southeastern Michigan. This industry has been, and probably will continue to be, the largest consumer of iron powder.

Construction of the plant in Toledo is expected to be completed sometime in the summer of 1954. Because the process is largely automatic and continuous in operation, employment will probably not exceed 100 persons.

The Republic process utilizes iron ore both from Republic's Adirondack mining operations and also ore mined in Liberia, West Africa, by the Liberia Mining Co., in which Republic has a majority stock ownership.

The process resulted from knowledge gained in a continuing study by Republic of the direct reduction of iron ore to high purity iron.

"Direct reduction" is the term generally applied to processes by which iron or steel may be produced directly from iron ore. Conventional steelmaking utilizes a dual process — first, the smelting of the ore to a form of iron in a blast furnace, and second, converting this iron to steel. No direct reduction process economically practical for steelmaking in the United States has ever been developed. The tremendous initial cost of conventional blast furnace and steelmaking facilities has provided an incentive for continued research into direct reduction.

Republic started its investigations into direct reduction processes shortly after acquiring its iron mining properties in the Adirondack region of New York state in May, 1938. Although Adirondack ore is low in iron content, it can be beneficiated readily into a very fine quality ore with a high iron content and a low percentage of deleterious elements, ideal for direct reduction. In this beneficiated form, it has been used by Republic for fifteen years as a raw material for blast furnaces in the conventional iron making process.

In 1948, and for several years thereafter, Republic joined forces with the Henry L. Crowley Co., Inc., of West Orange, N. J., in an intensified research program on the problem of producing iron from ore by direct reduction methods. The problem was

Precision mechanical parts such as these may be formed from iron powder produced by a new patented process of Republic Steel Corp. The parts are formed by pressing the powder between dies under high pressure and then heating the pressed part to temperatures at which the particles of iron weld themselves together forming a unified mass. Republic will build a plant to produce 50,000-lb per day of the powder at Toledo, Ohio.

AMERICAN CHEMICAL PAINT COMPANY

AMBLER CHEMICALS ACP PROCESSES PENNA.

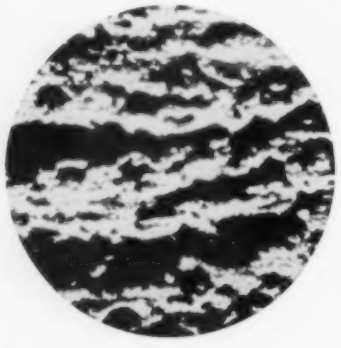
Technical Service Data Sheet

Subject: EFFICIENT PICKLING WITH RODINE®

ADVANTAGES OF "RODINE"

RODINE is used in sulfuric and muriatic acid baths for improved pickling and increased production. It meets Government Specification U.S.N. 51-I-2.

In straight line pickling of wire, rod and tubing, RODINE makes available more metal for drawing by protecting steel from acid attack. In batch pickling of sheet steel, RODINE improves the surface. In rapid, continuous strip pickling, RODINE not only saves acid and metal, but also prevents over-pickling during line shutdowns.



◀ *This steel surface was pickled in an uninhibited acid bath. Note the deep pits, and that the surface is visibly crystalline.*

This surface was pickled exactly like the one above except that "RODINE" was added to the acid solution. Only scale pockets and roll marks are visible; no pitting occurred. ▶

CHEMICALS ACP PROCESSES WRITE FOR DESCRIPTIVE FOLDER ON "RODINE" AND INFORMATION ON YOUR OWN PICKLING PROBLEM. CHEMICALS ACP PROCESSES

approached by a radically different method than any previously attempted. The process was studied several years in the laboratory and a pilot plant was constructed to prove out the process. Ultimately, it became possible to produce substantial amounts of a very pure iron powder day after day from either low grade or high grade ores.

While the process proved workable, its economics, so far, are not competitive with conventional steel industry processes in a peace-time economy. However, from this reaserch, new experience was gained. The result was the perfection of a process which is wholly owned by Republic and will be utilized in commercial production of iron powder at Republic's new Toledo plant.

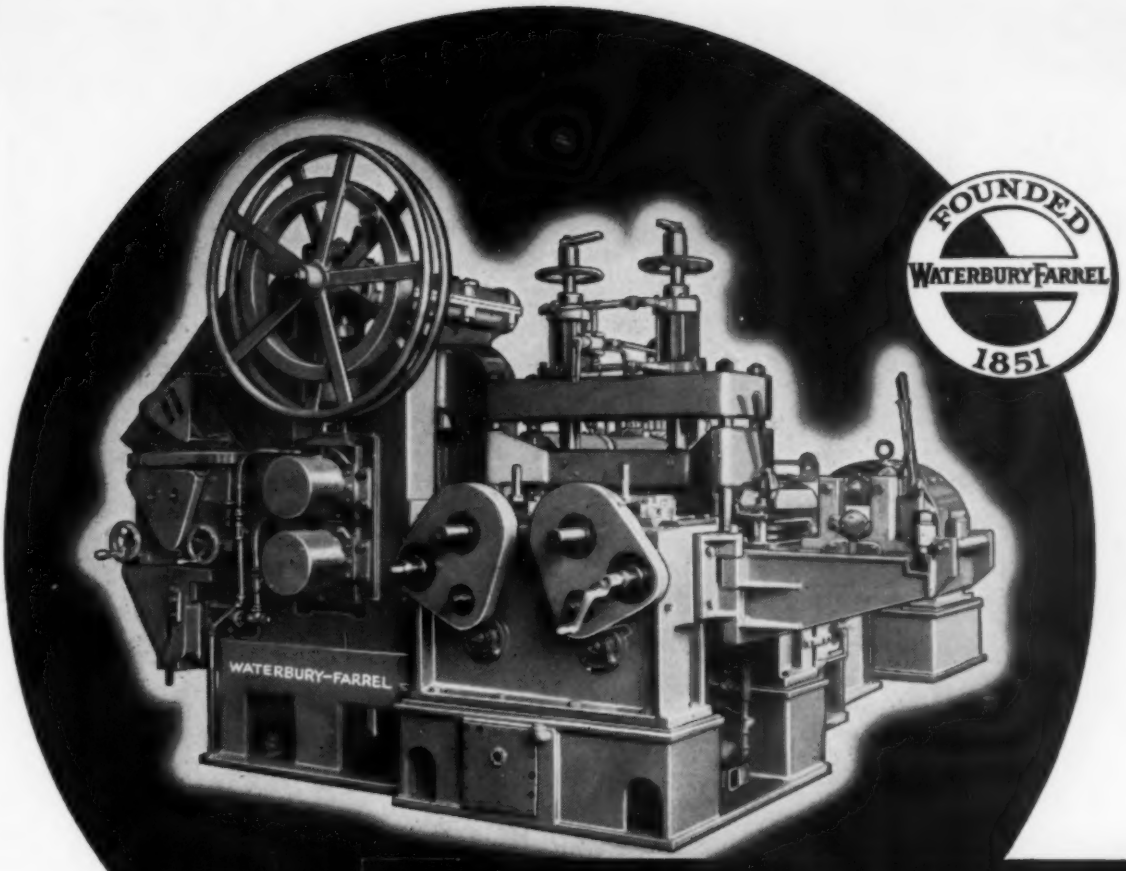
NEW CLAD METAL PLANT READY FOR OPERATIONS

▲ A new clad metal plant which will produce gilding metal clad steel strip for bullet jackets for the United States Army is ready for full scale operation by Superior Steel Corp. The plant will increase Superior's clad metal capacity from 30,000 tons to approximately 80,000 tons per year.

Built and equipped jointly by Superior and the Ordnance Corps at a cost of $7,757,865, the plant will operate under new methods and processes which are expected to save the government between $100 and $150 a ton. The basic clad metal process, which Superior developed in 1939, has saved 80 per cent of copper and zinc in each bullet jacket.

The plant will operate under a unique contract between Superior and the Ordnance Corps — one of the few of its type ever entered into by the Government with private industry. The contract provides that the Government shall have first call on the production of the new plant, but that the facilities may be used commercially when they are not required for Ordnance production. Superior will pay the Government rental on all Government-owned facilities used for commercial production.

In 1939, Superior originated a patented method and apparatus for producing strip steel clad with either gilding metal (90 per cent copper 10 per cent zinc) or cupro-nickel. The advantages of long coils of clad strip over short lengths of sheared sheet for use in high speed automatic presses



BAR FINISHING MILL

Variable Speeds up to 360 feet per minute, or more

- **Up-to-the-minute design.**
- **10-¾″ diameter rolls.**
- **Combination Coiler-Straightener.**
- **Double Edger with Hydraulic Hold Down**
- **and other outstanding features.**

If your problem is Mill Equipment for light gage steel or for non-ferrous materials, be it —

SHEETS • STRIP • WIRE • ROD • SHAPES OR TUBES

Let's Talk It Over! We are sure we can help you!

Waterbury Farrel

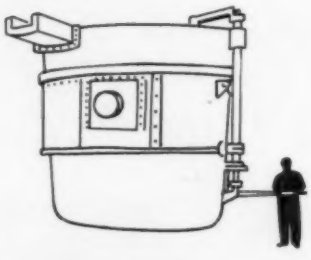
FOUNDRY & MACHINE COMPANY

WATERBURY • CONNECTICUT • U.S.A.

to Build a Better LADLE*

* . . . this 285-ton Pollock Open Hearth Ladle is welded on a special positioner designed specifically for jobs like this. The ladle is placed on the rollers and revolved until the ladle is in the best possible position for "down-welding." Using the positioner results in better welds. A positioner for a 285-ton ladle is big . . . it has to be. But at Pollock, where thinking is as big as the job itself, huge machines are commonplace.

The William B. Pollock Company prides itself on being able to do the big jobs. It has the skilled men, the resourceful engineers and the special machines (as this positioner) that are needed to turn your biggest drawing board dreams for iron and steel making facilities into solid, practical realities. When you're thinking "big," think of The William B. Pollock Company . . . specialists in all matters and equipment pertaining to the manufacture of iron and steel.



THE WILLIAM B. POLLOCK COMPANY

Since 1853

YOUNGSTOWN, OHIO

STEEL PLATE CONSTRUCTION • ENGINEERS • FABRICATORS • ERECTORS

BLAST FURNACES • HOT METAL CARS AND LADLES • CINDER AND SLAG CARS • INGOT MOULD CARS • CHARGING BOX CARS • WELDED OPEN HEARTH LADLES

were apparent immediately. Frankford Arsenal lent invaluable assistance in causing gilding metal clad steel strip to become adopted as a standard specified material for use in certain components of small arms ammunition. The arsenal convinced our cupronickel using allies to adopt gilding metal clad and thus release untold quantities of nickel for more vital uses.

Superior licensed 18 steel companies, royalty free, to produce clad metal for small arms ammunition components during the war. Superior alone produced about 120,000 tons of gilding metal clad steel and in so doing made available, for other purposes, 80,000 tons of copper and 10,000 tons of zinc.

The original World War II clad metal had been made by peening nonferrous (gilding metal) plates into a modified I-beam shape of steel. These steel sections were limited in width to about ten inches and in weight from 600 to 10,000 lb each.

The method of cladding today involves the use of a new type welded angle assembly which removes the limitations on weight of the assembled clad slab imposed by the old I-beam method. The assembly is heated and hot rolled into strip, pickled, cold rolled, normalized or annealed, repickled and slit into desired widths. The finished strip consists of specified thicknesses of clad metal, inseparably bonded to one or both sides of the core and in condition suitable for blanking, drawing, or whatever further processing is required to produce a finished part. Present clad billets weigh about 2,000 to 3,000 lb each in widths up to about 17 in.

The new plant was erected with galvanized steel roofing and aluminum siding covering 100,000 sq ft of floor space. Its production line progresses through an elongated "S" shape and is a model of modern plant layout.

Although the plant was equipped mainly from government funds, the Superior Steel Corp. supplied the land, buildings, water mains, sewer lines, drive-ways, electric lines, overhead cranes and the heating plant.

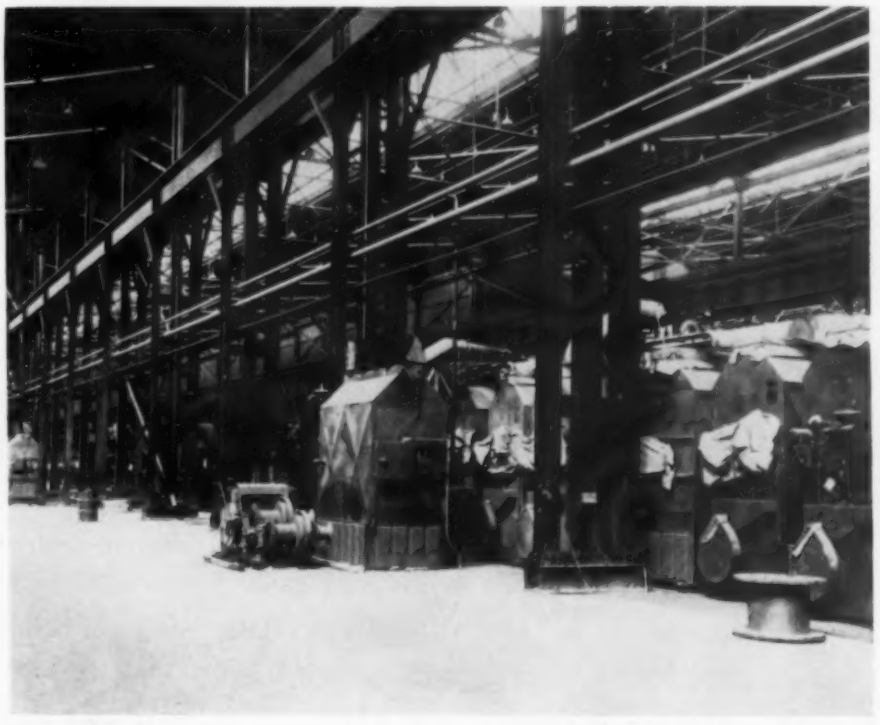
OFFICERS ELECTED AT ANNUAL MEETING

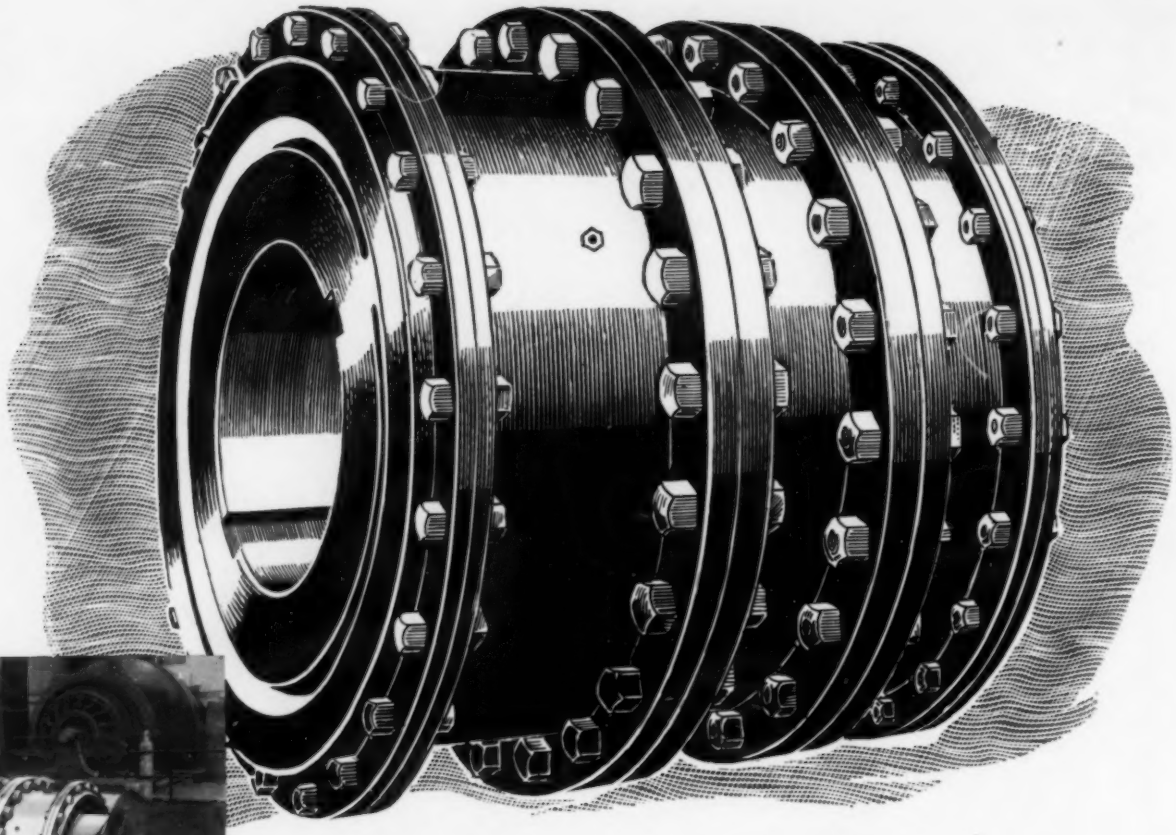
▲ At the annual meeting of the Council of Engineering Society Secretaries on June 5 and 6, at Atlantic City, N. J., the following officers were elected for the coming year: Ernest Hartford, American Society of Mechanical Engineers, becomes president; Edward H. Robie, American Institute of Mining and Metallurgical Engineers, was elected vice president; M. C. Turpin, American Society of Refrigerating Engineers, was elected treasurer; and

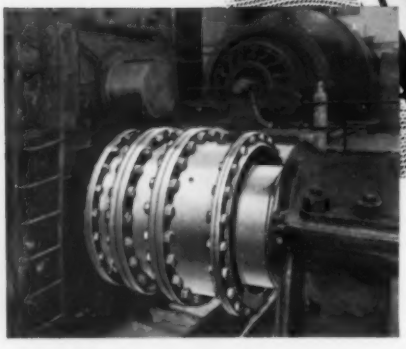
Members of the Council of Engineering Society Secretaries pictured at Atlantic City, N. J. for their annual meeting. Among those elected to office for the coming year was T. J. Ess, Managing Director of the Association of Iron and Steel Engineers, who will serve as a director.

PITTSBURGH STEEL INSTALLS SPACE HEATERS

Initial installation of warm-air space heaters in the expanded facilities of Pittsburgh Steel Co. at Allenport, Pa. Sixty-two of these heaters, in output capacities ranging from 500,000 to 2,000,000 Btu per hour, were purchased from Dravo Corp.'s heating department to furnish comfort heating in the one-story blooming-mill, sheet-strip and pipe-mill buildings.







This 30″ Bore Fast's Coupling is on the main drive of the blooming mill at a large Eastern steel mill . . . one of many Fast's linking power to production at this installation.

For SAVINGS up to $30,000 per hour... FAST'S Couplings are FIRST!

A coupling failure in the steel mill installation shown here would cost this mill $30,000 for every hour of down-time! That a Fast's Coupling was selected for this vital spot is striking testimony to the reputation for rugged dependability Fast's Couplings have enjoyed through the years. And Fast's guarantees *you* the same protection against costly shutdowns, whatever your coupling applications!

Remember: Fast's Couplings give you *rugged construction* . . . the original design has been maintained without basic change or sacrifice in size or materials. Fast's Couplings give you *lowest* cost per year . . . *Fast's usually outlast the equipment they connect.* And Fast's Couplings give you the benefit of Koppers *free engineering service* . . . assuring you of the right coupling for any job and the right solutions to tough coupling problems.

For full details on how Fast's Couplings and Koppers Engineering Service can help you insure uninterrupted power transmission, write today for your free copy of our catalog to: KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 217 Scott Street, Baltimore 3, Md.

KOPPERS®

THE ORIGINAL

FAST'S Couplings

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • BALTIMORE, MD. This Koppers Division also supplies industry with American Hammered Industrial Piston and Sealing Rings, Koppers-Elex Electrostatic Precipitators, Aeromaster Fans and Gas Apparatus.

Engineered* Products Sold with *Service

KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 217 Scott St., Baltimore 3, Md.

Gentlemen: Send me a Fast's Catalog giving detailed descriptions, engineering drawings, capacity tables and photographs.

Name .....

Company .....

Address .....

City ..... **Zone** ..... **State** .....

THIS PICTURE TELLS A STORY of a new cost-cutting opportunity for steel mills

Note the ready accessibility of each item of steel in this storage yard of a well-known steel mill. It's this availability of materials that's one of the prime advantages of the ROSS STRADDLE CARRIER handling method . . . an advantage, unmatched by any other method, that eliminates delays, lowers costs and increases the production efficiency of the mill.

ROSS STRADDLE CARRIERS, heart of the Ross unit-load handling system, are built to handle 45,000-pound concentrated loads on around-the-clock schedules in the roughest, toughest steel mill service . . . to put those loads *where* wanted *when* wanted.

Your mill, too, can profit by this modern, flexible mass handling system. Get in touch with Ross today for the complete details.

Rely On ROSS

THE ROSS CARRIER COMPANY

Direct Factory Branches and Dealers Throughout the World

400 MILLER ST., BENTON HARBOR, MICH., U.S.A.

Charles S. Doerr, Engineering Society of Philadelphia, was named treasurer. Elected as directors were: O. Laurence Angevine, Rochester Engineering Society, H. H. Henline, American Institute of Electrical Engineers, J. Earl Harrington, Western Society of Engineers, and T. J. Ess, Association of Iron and Steel Engineers.

U. S. STEEL CLOSES MORGAN COAL MINE

▲ Due to the exhaustion of coal in U. S. Steel's National No. 1 mine at Morgan, Pa., the mine ceased operation on June 26 and will be permanently closed down.

The mine, which has been in operation over 50 years, employed 220 men at the present time and has been producing approximately 900 tons of steam coal daily.

The men are being given an opportunity to apply for employment at other U. S. Steel operations.

TO SELL WELDING STUDS DIRECT TO CUSTOMERS

▲ Plasteel Products Corp., Washington, Pa., has just concluded an arrangement under which it will supply Nelson "Rivweld" studs direct to purchasers and applicators of its protected steel roofing and siding materials.

J. B. Cowan, executive vice president of Plasteel, pointed out that the Nelson Stud Welding method for high quality installation of roofing and siding entirely from the outside has resulted in substantial labor savings which enable erectors to earn a larger return and still show a saving to building owners — particularly in the application of mica-protected Plasteel.

"The widespread availability of Nelson stud welding equipment, which can now be obtained on a rental basis in almost every part of the country, has greatly extended the opportunity for use of this new fastening technique," Mr. Cowan added. "Exhaustive experiments and field testing have convinced us that this is an excellent fastening technique for use in Plasteel installations."

Mr. Cowan went on to say that Nelson stud welding guns can now be operated from portable battery-powered welding units, making it possible to use this method at sites where

HEPPENSTALL GIANT

This shaft, made from the largest ingot ever cast at Heppenstall Co., Pittsburgh, Pa., steel forgings manufacturer, was the subject of much interest at a recent open house. Two open-hearth furnaces were tapped simultaneously to produce the original ingot, which weighed 103,000 lb. Forging operations reduced its weight to 73,000 lb. It was then machined down to the exact size and shape required, its final weight being 33,000 lb.

other power is not directly available. These units have a built in charging machine and can be charged overnight by plugging into any standard 110 volt convenience outlet, and then returned to the construction site the next morning.

Plasteel is the first producer of protected metal roofing and siding to carry a regular stock of Nelson studs for sale to purchasers of its products, according to Leonard C. Barr, vice president and general sales manager of the Nelson Stud Welding Division of Gregory Industries, Inc.

KOPPERS TO BUILD COKE OVEN BATTERY FOR J&L

▲ Jones & Laughlin Steel Corp. has awarded Koppers Co., Inc., a contract to design and build a new battery of 79 chemical-recovery coke ovens at its Hazelwood plant, Pittsburgh, Pa.

Officials of Jones & Laughlin said that the new battery is to be built as part of the company's expansion and modernization program at Hazelwood. It will be of the Koppers-Becker type, a large battery of which is just being completed at Hazelwood by Koppers. Koppers also has constructed several large batteries of these ovens for Jones & Laughlin at its Aliquippa, Pa., Works.

A total of 1,925 net tons of coal will be carbonized each day by the new battery, which will replace an old battery of 50 ovens that carbonized 850 net tons per day. The new ovens will be fired with coke oven gas.

ESTABLISHES SPECIAL PRODUCTS DIVISION

▲ Lake Erie Engineering Corp., Buffalo, N. Y., designers and manufacturers of hydraulic presses and special machinery, has announced the establishment of a rolling mill and special products division for the supply of a broad line of auxiliary rolling mill equipment for ferrous and non-ferrous metals.

The division is under the direction of J. P. Finkbone, who has recently joined the Lake Erie organization. Mr. Finkbone is well known in this field having previously served as executive vice-president of the Arms-Franklin Corp., Youngstown, Ohio, and previous thereto, in production and engineering capacities with Western Brass Mills, Timken Roller Bearing Co. and Armco Steel Corp.

L. L. Freret, who has recently joined Lake Erie, serves as chief engineer of the division having had wide design and operating engineering experience with many firms in this field including Arthur G. McKee Co., National Tube Co., Tube Reducing Corp. and Armco Steel Corp.

The new Lake Erie division offers complete design and manufacturing services for a wide range of auxiliary equipment such as mill tables and conveyors, coilers and uncoilers, shears, stretchers, levelers, pilers and unpilers, as well as complete lines for slitting, annealing, cleaning, etc.

Such equipment will be manufactured at Lake Erie's Buffalo plant which has in the past served the rolling mill industry on many special manufacturing and rebuilding contracts.

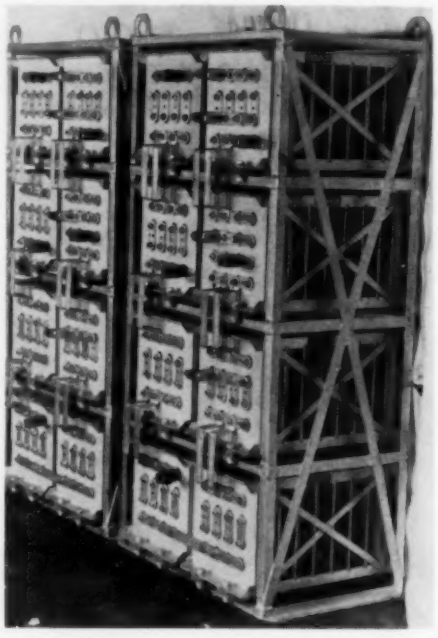
MARKS FIRST SHIPMENT FROM ALLENPORT PLANT

▲ Pittsburgh Steel Company today announced its first shipments of steel sheets from its new hot rolled sheet mill at Allenport, Pa., are enroute to the Chrysler and Packard automobile companies.

The sheets are top quality hot rolled pickled and oiled in coils 56-in. in diameter. Each package contains three coils, or enough steel for about 27 automobile bodies.

GUYAN RESISTORS

CAN END YOUR RESISTOR TROUBLES!



Featuring helical coil resistance elements of chromium alloy steel, GUYAN Resistors are ruggedly constructed to withstand shock, vibration and overload.

•

GUYAN RESISTORS ARE CUSTOM BUILT TO YOUR REQUIREMENTS

•

GUYAN MACHINERY CO.

LOGAN, W. VA.

Shipment of these coils signals completion of test runs on the new 66-in. semi-continuous hot sheet mill. The mill is now entering its break-in period before starting large-scale commercial production.

Rapid progress is being made on construction of facilities for cold rolling steel sheet in a mill adjacent to the new hot mill. With both mills in operation, output of hot and cold rolled sheets will build up to 600,000 net tons per year.

Completion of the hot mill concludes another phase of the company's $62.8-million expansion program, which includes: (1) An increase in blast furnace capacity by 12 per cent. (2) An increase in open hearth capacity by 48 per cent. (3) Construction of five new blocks of soaking pits and installation of a new 66-in. high-lift blooming-slabbing mill. (4) An increase in finishing facilities of 82 per cent.

Workmen are seen inspecting one of the first shipments of steel sheets from Pittsburgh Steel Co.'s Allenport, Pa. plant. Destined for the Chrysler Corp., the shipment completes the test runs of the company's new 66-in. semi-continuous hot strip mill.

COMPLETES PILOT PLANT FOR CHAR PRODUCTION

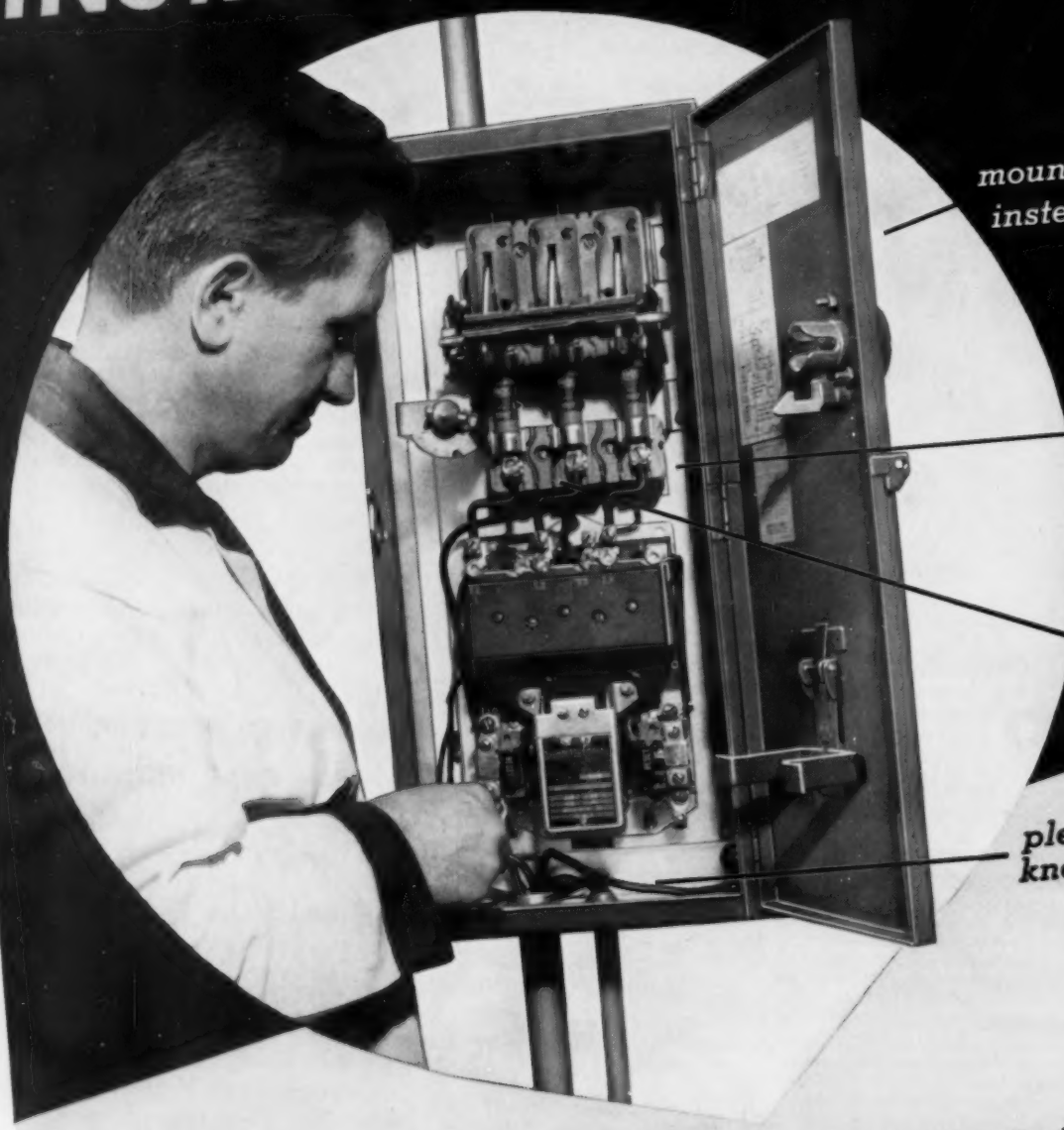
▲ Designed to make "young" Colorado coal grow several million years older in a matter of minutes, a new pilot plant for the test production of char has just been completed at the fully-integrated Pueblo, Colo., steel mill of Colorado Fuel and Iron Corp. The new Petit char plant is the second of its kind in the world.

Colorado coal is believed to be about 80 million years younger than eastern coal. It is therefore more highly volatile (easily vaporized). The new char plant is actually a low-temperature furnace which removes part of the excess volatile matter of this western coal, producing a low-volatile coal or char for blending with other coals. Mixing the resultant char with Colorado coking coal improves the quality of coke, which is later used in steel making.

The Petit process char plant handles one ton of coal per hour, and 1600 lb of char is recovered. Two gas burners feed 2500 ft of flaming gas per hour into a vertical chamber that zigzags 50 ft down the center of the

HERES WHERE ECONOMY REALLY COUNTS!
LEADING STEEL MILLS USE AND RECOMMEND
BUCKEYE SILICA FIRESTONE
FOR LONGER SOAKING PIT SERVICE
What features do you require in your soaking pit linings—savings in fuel costs? . . . greater mechanical strength and rigidity? . . . low first cost and shorter installation time? . . . corrosion resistance? . . . much longer life? . . . freedom from repairs? . . . these features and many more can be enjoyed by you after you install Buckeye Silica Firestone.
Performance records prove that Buckeye is the best. Heads of masonry departments appreciate and recommend this modern refractory's money-saving installation possibilities . . . operators know how much longer service can be expected from a Buckeye-lined pit!
Steel mill executives, who have used Buckeye Silica Firestone for years, will give you many reasons for your specifying this up to date, better lining material for your soaking pits. Our service engineers will gladly work with you to obtain the finest possible results from your Buckeye installation. Ask for this service.
THE CLEVELAND QUARRIES COMPANY
REFRACTORY DEPARTMENT
1740 E. Twelfth Street
Cleveland 14, Ohio
Send for free literature today!
BUCKEYE SILICA FIRESTONE
BUCKEYE
"FOR THAT EXTRA SERVICE"
SILICA FIRESTONE

EASIER TO INSTALL AND MAINTAIN!



mount 1 device instead of 2

extra-wide gutters

all components accessible from front

plenty of knockouts

SQUARE D COMBINATION STARTERS

(Switch or Circuit Breaker Types)

Save space and time. Mount and wire one device instead of two . . . neater, more attractive installations.

Write **for Bulletins 8538 and 8539**
Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

1903 • 50 YEARS OF DESIGN LEADERSHIP • 1953

tower, where a steady flow of coal is converted into char.

Begun in January of this year, the char plant was constructed by CF&I engineers working with the Koppers Co., Inc., of Pittsburgh, according to the plans of the Societe de Technique Industrielle of Paris, France, headed by M. Daniel Petit, designer of the plant.

Now that char can be produced in quantity at Pueblo, the true value of this method of improving western coal can be established, over a period of time. Test charges in coke ovens and blast furnaces are planned as definite and final proof of the value of char blending.

However, this is not the first char plant used by CF&I. Back in 1942, an experimental Hayes retort was built near the site of the new Petit plant. Results of this experiment were reported throughout the world and played an important part in the development of char theory. Some parts of the old plant were utilized in the construction of the new one.

"It is too early to estimate the effect this test char plant will have on CF&I's future steel production," A. F. Franz, president of Colorado Fuel and Iron said, "but completion of the pilot char plant is a significant step in our long-range plan to utilize fully the steel-making resources available to us locally. Development of our new Allen mine in southern Colorado, with its intensive mechanization and latest-type belt conveyor systems, earlier this year, represented the achievement of a major step in this program. Large reserves of coking coal have been one of the important factors in the continued program of expansion and modernization of the Pueblo mill. Completion of the pilot char plant is merely another part of our continuing search to make the best possible use of this vital resource."

While CF&I has pioneered in research into the value of char in steelmaking in the United States, the process itself dates from 1908, when Kotara Shimomura, a Japanese inventor, was one of the first to develop the theory of mixing char with high-volatile coal. Hundreds of processes have since been tried, and experiments continue. The process of Daniel Petit of Paris, now being applied by Colorado Fuel and Iron, represents one of the most advanced methods.

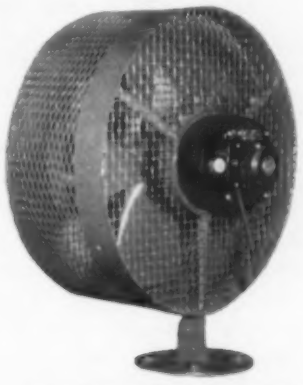
KOPPERS PLANT MAKES GUN MOUNT FOR TANK

▲ Combination gun mounts and recoil mechanisms for the 90 mm guns that help make the new Patton 48 Medium Tank the finest of its type are coming off the production lines at Baltimore, Md., it was announced. Walter F. Perkins, vice-president and general manager of Kopper's Metal Products Division, said that Koppers is producing this equipment for the Chrysler Corp.'s new Delaware Tank Plant at Newark, Del., which has the prime contract to build the Patton 48's for the Army.

Function of the Koppers-built equipment is to mount the new 90 mm high velocity gun in a one piece cast steel turret and to absorb the recoil of the gun so that the breach is returned to firing position quickly, but gently, after a shot has been fired.

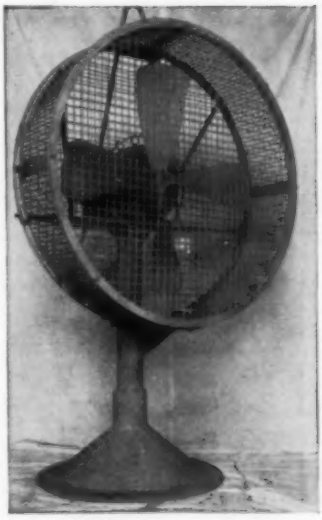
Unique design of the concentric recoil mechanism makes it possible

IS HEAT SLOWING UP YOUR WORKMEN?



TRUFLO CRANE CAB FANS
For cooling interiors of crane cabs and other confined areas. Adjustable both horizontally and vertically. Four blade type, 12 and 18 in. sizes.

Keep them COOL with TRUFLO FANS



TRUFLO PORTABLE COOLING FANS
Easily portable. Help keep efficiency high where work is hottest. 12 to 36 inch diameters.

Production suffers when workmen are overheated. Steps begin to drag, efficiency falls.

Now, when speedy production is vital, Truflo Fans can help keep your workmen on their toes. All Truflo Fans are designed and built correctly to put fresh cool air *in large volumes* exactly where it is needed. Perfectly-balanced shafts and blades give more air per h.p. . . . strong steel frames stand up longer under hard use . . . rugged wire guards protect men against injuries.

All of the following types can help beat the heat, keep production moving in your plant. Write for illustrated literature.

PORTABLE COOLING FANS
CRANE CAB FANS • WALL FANS
EXHAUST FANS • BLOWERS
ROOF VENTILATING FANS
PENT HOUSE FANS

TRUFLO FAN COMPANY
245 MAIN ST., HARMONY, PA.

New Pickling Inhibitor Preserves Surface During and *AFTER* Scale Removal

Houghton "Acitrol 3129" effective across-the-board . . . assures minimum breakdown over long periods at high temperatures!

SAVES STEEL AND ACIDS

This new liquid inhibitor does the vital job of protecting the metal against acid attack after the scale is removed as well as during the operation. Acid is conserved while the steel is preserved. Acitrol also prepares the surface for good coverage of subsequent finishes.

HOUGHTON ACITROL 3129

RESISTS BREAKDOWN UP TO BOIL

Houghton Acitrol 3129 maintains its effectiveness over the full temperature range—resists breakdown even in pickling installations run at long periods over 200° F. This means you can benefit through the increased production rates Acitrol makes possible. And low temperature baths may be maintained effectively even if less inhibitor is used.

USED ACROSS-THE-BOARD

This fast-dissolving liquid works well in either sulphuric, hydrochloric or phosphoric acid baths. Whether the acid dilution is mild or strong, Acitrol 3129 does the job. It requires no premixing. Picklers find it convenient to use.

STAYS STABLE IN STORAGE

Add Acitrol 3129 to concentrated acid, hold it in storage, and you'll find it ready for effective protection when you want to use it. It remains stable. It stays uniform from batch to batch.

YOU BENEFIT COST-WISE, TOO

Acitrol's stability, efficiency and ability to conserve steel and acids are all indications of its low cost per ton of steel pickled. Houghton Acitrol 3129 is available in 15, 30, and 55 gallon drums and well worth a trial. Get prices and further information from your Houghton Man or write E. F. Houghton & Co., 303 W. Lehigh Ave. Philadelphia 33, Pa.

WRITE FOR BULLETIN

Houghton Acitrol 3129

ACITROL 3129 *product of*

E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

to replace the big 90 mm gun tube in 10 minutes if the tube is damaged. Previously, replacement of a tube required 18 hours.

More than 150,000 sq ft of floor space at the Bartlett Hayward and South Baltimore plants of Koppers are devoted to the precision manufacture of the many component parts. At peak production, some 500 persons will be employed by Koppers on this project alone.

Starting with raw material, the units are welded, heat treated, machined and assembled in modern shops, using advanced production techniques. When completed each gun mount is thoroughly tested under simulated firing conditions using special equipment designed and built in the Baltimore plants. Assembly and testing is done in a dust-proof room constructed especially for the job.

Permanent tooling for production required almost a year despite high priorities. Specialized copying lathes, internal and external grinders and huge vertical hones were taken out of moth balls at government storage depots, while other tools came direct from American and foreign machinery manufacturers.

Koppers, Chrysler, the Army Ordnance Corps and other tank prime contractors worked hand-in-hand solving the many engineering problems on this new type gun mount. Engineering design and production methods are continually being improved to better the efficiency of the mount and to lower the ultimate cost to the government.

After testing at Koppers, the mounts are shipped to the Army's Aberdeen Proving Ground in Maryland where they are proof fired, then sent to the Chrysler Plant for installation on the new tanks.

Mr. Perkins also announced that Koppers Baltimore plants are producing machine gun cradle assemblies used in conjunction with the 90 mm mount, as well as steering, shifting, accelerator and braking controls for the Patton 48 tanks.

NEWPORT STEEL HONORS LONG-TERM EMPLOYEES

▲ Officials of Newport Steel Corp. at a dinner, recently honored 461 men and women who have spent 25 years or more of continuous service in steel

operations at Newport and Wilder, Ky. Each employee was presented with a gold and diamond pin. Fourteen men have 35 or more years of service, one has 47 years. Sixty-five now are retired under pension plan which became effective three years ago. The combined service of the entire group is 13,292 years.

Acting as toastmaster was Carl M. Riefkin, vice president, who came to Newport Steel directly from the University of Kentucky in 1924, as a purchasing department assistant. Speakers were Frank S. Gibson, Jr., chairman and president and A. P. Miller, vice president.

TO CONVERT CHARGING OF ELECTRIC FURNACES

▲ Plans to convert two 70-ton electric furnaces at Canton, Ohio, from side door charging to top charging have been announced by O. A. Bamberger, Central Alloy District manager of Republic Steel Corp.

In addition, facilities for performing induction stirring will be added to one of the two electric furnaces to be converted to top charging.

In addition to the charging conversions, the transformer capacity on one furnace will be enlarged from 12,000 kilovolt amperage to 20,000 kva. The transformer capacity of the other furnace to be converted to top charging already is 20,000 kva.

Another improvement which will be incorporated in the two top charge furnaces is installation of electrode holders which will permit slipping electrodes automatically. This will result in reducing the time required to make steel in the furnace.

The furnaces to be converted are in Republic's No. 3 Canton melt shop. To make the conversions, the charging floor, crane runway and track supports will be reinforced. Additional underground power facilities will be installed, new charging buckets and cars will be purchased and alterations will be made to an overhead crane to handle the large charging buckets used in top charging.

All work is expected to be completed before the end of the 1953.

Electric furnace steel is made almost entirely from high grade steel scrap. Under the standard side door charging or loading method, a charging machine picks up steel boxes filled with steel scrap, pushes them into the furnace and turns them over, dumping the contents into the furnace. Each box generally contains about 38 cu ft of scrap, the greatest practical amount by this charging method.

As Republic uses the top charge method on a 70-ton furnace, the roof and electrode arms are swung to one side and buckets holding 1,000 cu ft of scrap are suspended by a crane over the open top of the furnace. At the pull of a release chain, the bottom of the bucket opens, dropping the entire contents into the furnace.

With the side door charging method, it takes from two to three hours to charge completely a 70-ton electric furnace. This time is cut to about 25 minutes when the top charge method is used.

In recent years Republic has converted two 70-ton electric furnaces at South Chicago to top charging. From its experience, the company has found steel production may be increased by more than 50 per cent when top charging is used in conjunction with increased transformer capacity.

Top charging of electric furnaces was originated in the early 1920's. However, it was confined to smaller furnaces ranging from 10 to 40 tons in capacity until Republic converted a 70-ton furnace at South Chicago in 1950.

Induction stirring is a recently-developed process which causes a stirring motion of the molten metal in the furnace. This brings the metal in close contact with the refining slag in the furnace, thus aiding the chemical reactions which take place to reduce the oxides and gases in the metal.

Induction stirring also provides a homogeneous mixture of the steel and alloys added during the steel making cycle. This homogeneity enables the furnace operator to control the steel making process closely and thus improve the steel's quality.

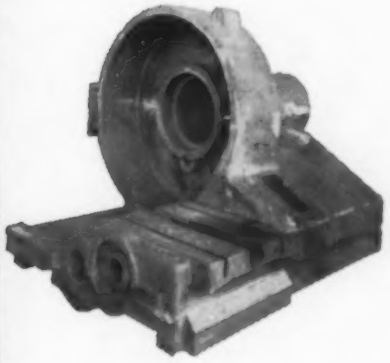
Induction stirring is achieved by installing at the outside and bottom of the electric furnace a series of water-cooled coils charged with spe-

Hyde Park

RED CIRCLE Rolls ALLOY-CHILLED

Gray Iron Castings

Castings of any size up to 80,000 pounds. Hyde Park facilities are equal to your every requirement



Machine Castings
Lathe Beds
Housings
Pinion Housings
Mill Housings
Shoe Plates
Layout Plates
Surface Plates

Hyde Park

FOUNDRY & MACHINE CO.
Hyde Park, Westmoreland County, Pa.
ROLLS
ROLLING MILL MACHINERY
GREY IRON CASTINGS

cial electrical current. The current is provided by generators, a frequency converter and a motor. The stirring action of the molten metal in the furnace is generated by the current flowing through the coils.

Republic is the world's largest producer of electric furnace steel. The company operates 17 electric furnaces ranging in capacity from 10 to 70 tons per heat at Canton and nine 70-ton furnaces at South Chicago.

Steels of the highest grade for aircraft, automobiles, bearings, magnets, many kinds of tools, engine valves and other important uses are produced in electric furnaces. Stainless and heat resisting steels are made almost exclusively by the electric furnace process.

NATIONAL TUBE RECEIVES SAFETY COUNCIL AWARD

▲ The Award of Honor of the National Safety Council, the nation's top industrial safety award, was presented to National Tube Division's Lorain, Ohio, works at a dinner meeting in Hotel Antlers on June 25.

Ned L. Dearborn, of Chicago, president of the National Safety Council, was the principal speaker.

Guests included top-ranking U. S. Steel and National Tube officials, officers and other representatives of the United Steelworkers Union — CIO, civic figures of Ohio and Lorain, and members of the management organization.

Robert Urquhart, general superintendent of Lorain Works, received word recently that the coveted honor was awarded to Lorain Works by the National Safety Council on the basis of the plant's 1952 safety performance.

In a statement issued at Chicago, the National Safety Council pointed especially to the period of 2,519,000 man-hours experienced by Lorain Works without a lost-time accident during 1952. The statement read:

"The combined experience of all steel-producing units of the U. S. Steel qualified for the Award of Honor. In addition, certain of the company's establishments qualified in their own right for the Award of Honor. The Lorain Works was one of these.

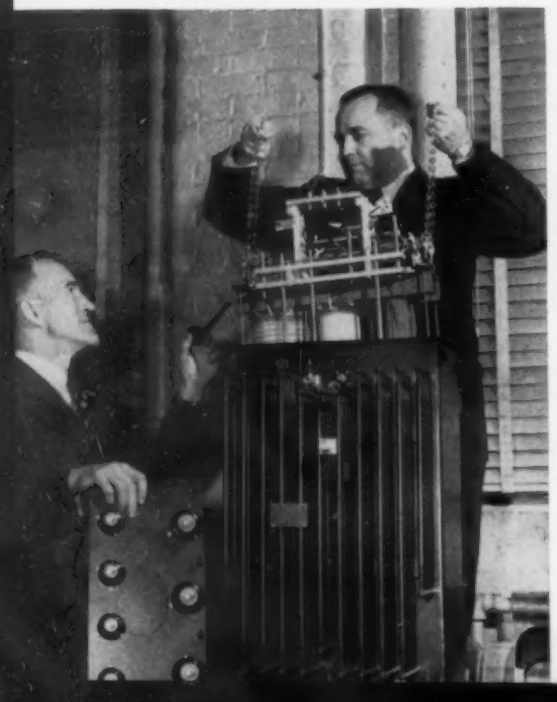
"To qualify, it needed reductions of 51 per cent and 30 per cent respectively below its frequency and severity pars. The reductions which it achieved were 53 per cent and 48 per cent.

"Its 1952 rates were 1.6 and .72 as compared with 1949-51 rates of 2.0 and 1.48. The steel industry averages for 1949-51 were 4.7 and 1.30.

"The Lorain Works operated 20,334,000 man-hours during 1952. They had a no-injury period of 2,519,303 man-hours from September 15 to October 23, 1952. This record met the requirement for the Award of Merit, but was granted instead the higher-ranking Award of Honor for which the Works qualified on the par-comparison basis."

MODEL TRANSFORMER

Training draftsmen, not building strong men, is the purpose of this model of a power transformer. Though one-fourth the size, it is a replica of a General Electric Repetitive-Manufacture transformer, rated 1500 kva, 22,900 to 2520/4360 Y volts. The model is being used in classes at Rome, Ga., where G.E. is building a new power transformer plant. Shown with the model are David B. Lawton, left, Rome plant manager, and T. F. Volkmer, the plant's manager of engineering. The multi-million dollar factory is scheduled to be completed early in 1954.



BLAW-KNOX TO BUILD NAVY TWIN GUN MOUNT

▲ Blaw-Knox Co.'s Lewis Machinery Division, Pittsburgh, Pa. is the prime contractor for the Navy's new 3-in. 50 caliber rapid fire AA twin gun mount shown above.

The complexity of this twin gun mount is evident from the fact that it has 28,000 separate parts with its total weight being 16 tons. The specifications require an accuracy on certain parts as close as 1 ten-thousandth of an inch. This is equivalent to 1/25th the thickness of newspaper stock.

This is the Navy's 3-in., 5 cal., rapid fire, anti-aircraft gun with twin mounts. Blaw-Knox Co.'s Lewis Machinery Division, Pittsburgh, Pa. has been designated prime contractor for the production of the new weapon.

Participating with Blaw-Knox in manufacturing this twin mount are 80 subcontractors and more than 220 sub-subcontractors.

CHARGE NEW GRANITE CITY OPEN HEARTH

▲ A new 300-ton open hearth furnace at the Granite City Steel Co., Granite City, Ill., was charged for the first time May 29. This is the first of three new open hearths being constructed as a major phase in the company's 68 million dollar expansion program. The other two furnaces were placed in operation at the end of June.

The three new open hearths are rated among the largest in the United States. Construction work on the furnaces was started in 1951 and included erection of 225-ft smoke stacks and an addition to the mill's number two open hearth shop which virtually doubles the floor space in this building. The shop houses four other furnaces rated at 250 tons each, and the mill's number one shop houses 10 furnaces with a capacity of 65 tons each.

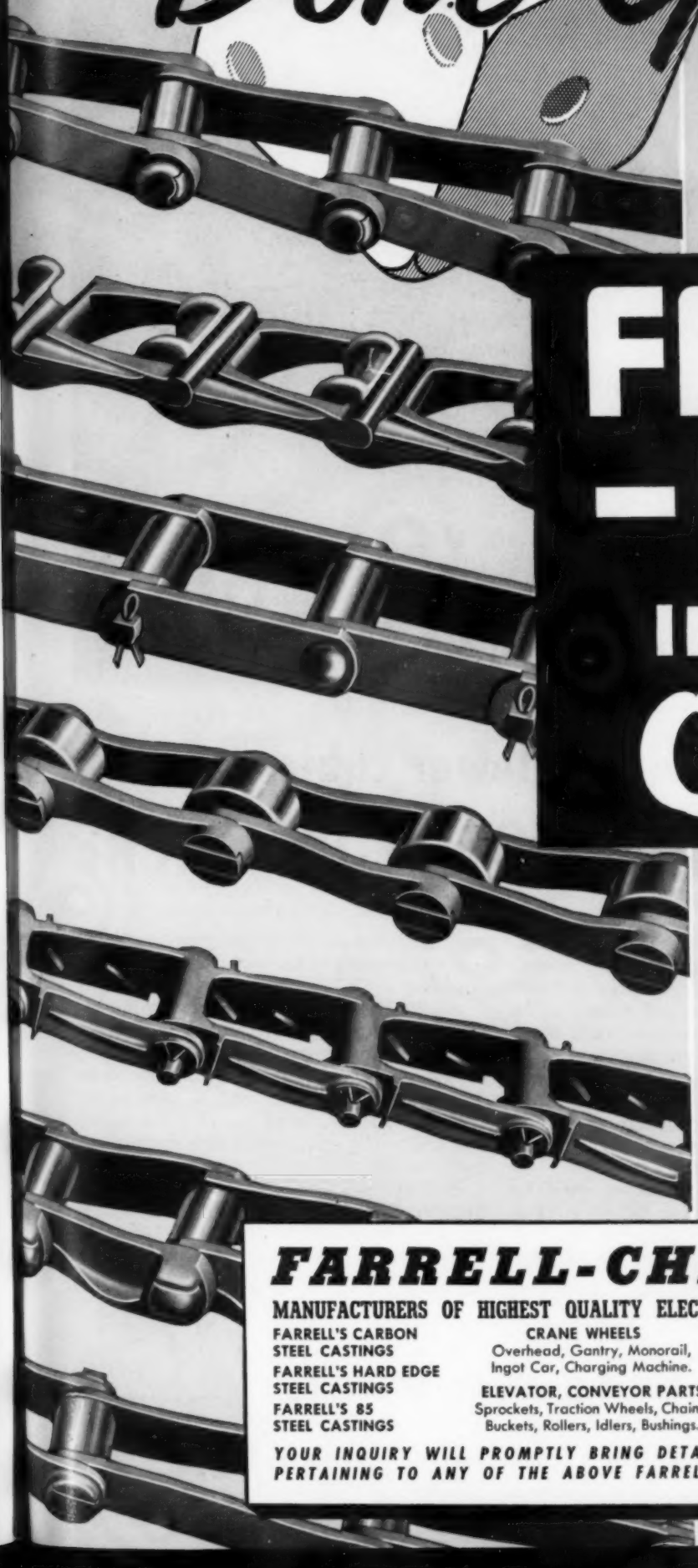
The three new furnaces, built for Granite City Steel by Rust Engineering Co., are of the most modern type and are equipped with the latest automatic controls.

Other major projects which have been completed were a 27 million dollar blooming mill which went into operation last month and 27 new coke

Don't Gamble!

USE

FARRELL-CHEEK INDUSTRIAL CHAIN



FARRELL-CHEEK STEEL CO.

MANUFACTURERS OF HIGHEST QUALITY ELECTRIC FURNACE CARBON AND ALLOY STEEL CASTINGS

FARRELL'S CARBON STEEL CASTINGS

FARRELL'S HARD EDGE STEEL CASTINGS

FARRELL'S 85 STEEL CASTINGS

CRANE WHEELS
Overhead, Gantry, Monorail, Ingot Car, Charging Machine.

ELEVATOR, CONVEYOR PARTS
Sprockets, Traction Wheels, Chains, Buckets, Rollers, Idlers, Bushings.

HEAVY HARDWARE
Complete line Wire Rope Fittings and Cutters, Bar Benders and Cutters.

GEARS AND PINIONS
"True Tooth" Gears and Pinions, Sheaves and Wheels.

RAILROAD CASTINGS
Locomotive and Car R. R. Specialty Castings.

STOKER PARTS
Feed Screws, Furnace Tools. Flanged Pipe, etc.

YOUR INQUIRY WILL PROMPTLY BRING DETAILED INFORMATION PERTAINING TO ANY OF THE ABOVE FARRELL-CHEEK PRODUCTS

SANDUSKY, OHIO

how to lower cable costs... specify OKOLITE-OKOPRENE

Specify electrical cable that is designed for tough jobs—that can resist heat, flame, moisture, dirt, mechanical damage and corrosive chemicals and you will reduce cable costs. Cable that can survive such steel mill conditions will give the best service at the lowest cost. You avoid unnecessary maintenance expense, production time losses and the cost of replacing cable that has worn out prematurely when you put Okolite-Okoprene cables on the job.

Okolite-Okoprene has proved itself to electrical men in the steel industry by a long record of trouble-free operation. The famous Okoprene protective sheath, an exclusive Okonite neoprene compound, will outperform any of the usual types of cable covering.

Additional life is given to the cable because it is made by the unique strip process which applies the insulation and sheath simultaneously. Long-lasting, high mechanical and electrical strength is assured by the perfectly centered conductors which are uniformly vulcanized in a continuous metal mold.

Bulletin IS - 1053 provides more information on the outstanding performance of Okolite-Okoprene. Write for it today to The Okonite Company, Passaic, N. J.

OKONITE PASSAIC, N.J.

OKONITE OKONITE SINCE 1878 *insulated cables*

75th ANNIVERSARY

1710

ovens in the blast furnace department. The last of the 27 ovens was charged May 28. Other major items still to be completed are three new slab furnaces, and a hot strip roughing mill.

ORIGINATE EMPLOYEES BLOOD DONOR BANK

▲ Mesta employees have established an employee blood donor bank. The project is now in full operation, and over 80 per cent of the employees are participating in the program.

The employees who register for membership, assure themselves and members of their immediate families that, in emergencies, the precious blood is available for them when it is needed at any time—day or night.

Members are now making their first "deposits." The second will not be accepted until every member of the bank has made the initial "payment." Blood will be typed and stored at the Central Blood Bank, located in the Falk Clinic, Pittsburgh, Pa.

Mesta Machine Co. provides transportation from its plant to the Central Blood Bank, and return, without cost to the bank members. This is daily from 9:00 a.m. to 9 p.m. except Sundays and holidays. Members do not lose time nor wages enroute to and donating blood at the bank.

The blood donor program originated with two veteran employees of the company—Edward Wellman and Joseph Suhoza.

Wellman is an air tool repairman with eleven years on the job. Suhoza is a machinist who operates a milling machine and has completed nineteen years at the Mesta plant.

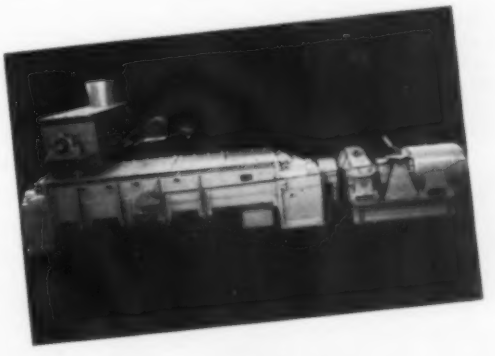
Recently these two became concerned by the problem that arose whenever a call would come into the shop requesting blood donors in a hurry for a fellow worker or someone in his family. They reasoned that a private blood bank, established by Mesta's own employees for Mesta's workers and their families, would provide for such emergencies in advance.

An outstanding feature of the program is that a member who retires, will continue to hold "blood shares" as an active member. Those who are on leave of absence may retain active membership for a maximum of two years.

New Bailey FEEDER

Improves Pug Mill Operations

Bailey Pug Mills long have been recognized as outstanding for efficiency in sintering plant and blast furnace dust catcher use. Now, their service to industry can be made even more efficient through the use of the new Bailey Feeder. Operating by means of a motor-driven screw conveyor, the feeder makes possible substantial savings through the reduction of hand labor.



Bailey Feeder used with a Bailey double-shaft dust catcher Pug Mill.

WILLIAM M. Bailey COMPANY
ENGINEERS
LEADERSHIP THROUGH QUALITY
1221 BANKSVILLE ROAD PITTSBURGH 16, PA.

A member's participation in the program grants the privilege of receiving blood from the bank to (1) the husband or wife and unmarried children living in the member's household unit; (2) mother and father of the member; and (3) the unmarried brothers and sisters of the member living in his household unit.

According to the Mesta personnel department, a member of the program may be called for a pint of blood only once in several years. Present estimates reveal that it will probably be five to seven years between blood donations for any member. This is readily understood, since Mesta has 3800 employees.

SPEED STEEL SAMPLES IN PNEUMATIC TUBES

▲ Traveling faster than a man can run, open hearth steel samples now speed from furnace to laboratory — a distance of about a tenth of a mile — in less than 20 seconds via pneumatic tubes at the Roebling, N. J. steel mill of the John A. Roebling's Sons Corp., a wholly-owned subsidiary of Colorado Fuel and Iron Corp.

The newly-installed system simplifies the problem of maintaining a consistently high-quality steel by permitting more frequent quality-control checks, Charles R. Tyson, executive vice president of Roebling's, said. "Several samples may now be checked in the time it formerly took to check one," he pointed out. "The pneumatic tube system will step up our overall steel production, and also cut out a sizable amount of human drudgery."

Similar in operation to the pneumatic tubes used by some large department stores for handling cash between points of sale and a central cashier's office, the installation at the Roebling plant is not unique in the steel industry, but it is believed to be the first used in a closely-integrated operation such as Roebling's, with lab directly adjacent to the open hearth furnaces.

The three-inch pneumatic tubes service all nine open hearth furnaces at the Roebling mill. Steel samples may be sent directly from any one of the furnaces to the lab, analyzed in two or three minutes, and then returned, seconds later, to one of three pick-up points, complete with carbon analyses. This enables melters to handle a greater number of furnaces with much less physical fatigue.

Installation of the new pneumatic tube sampling system is part of a broad program of expansion and modernization of present facilities currently taking place throughout the 12 plants of Colorado Fuel and Iron.

ALLOY STEEL PINION

This forged alloy steel pinion gets an honorable discharge at a Bethlehem Steel Co. plant after more than 22 years of rugged service in a rolling mill. The pinion, weighing 7 tons, helped produce 6,500,000 tons of steel at the Bethlehem, Pa., plant. It rotated the rolls of a 46-in. bloomer supplying an historic Grey mill — prominent for producing America's first wide flange structural shapes for skyscrapers. Forged and machined at the plant, the pinion was installed in the mill in 1930. It was recently removed and replaced with a new pinion.

DESCRIBES EXPERIMENTS ON TACONITE BLASTING

▲ Nearly four years of experimental work by the U. S. Bureau of Mines, Department of the Interior, to develop more economical and efficient methods of blasting taconite — the hard, iron-bearing rock now being developed by industry on Minnesota's Mesabi Range—are described in a report just released.

The experiments were conducted between August, 1946, and June, 1950, primarily to determine the possible advantages of using shaped dynamite and other explosive charges to blast taconite. The Armed Forces found shaped charges effective in armor-piercing projectiles during World War II.

This research involved three different steps — primarily blasting of taconite using shaped charges in holes drilled into the rock; secondary blasting of taconite using shaped charges on top of rock fragments already broken by the initial blasting; and primary blasting of taconite using conventional charges in horizontal, inclined and vertical holes drilled into the rock.

Charges were shaped into triangular, elongated cylindrical, and rectangular sizes. Shaped charges showed no advantage over conventional charges when used for blasting taconite from the ore face, the report states. Conventional charges proved more effective for breaking up oversize blocks. Blasts for which the explosives were loaded in holes drilled in staggered, parallel rows broke the most ore, and firing the explosives with millisecond delay detonators instead of simultaneously made the broken ore easiest to remove.

The blasting studies were undertaken in an effort to provide information to bring down the cost of mining taconite which is high in part because of the difficulty of breaking taconite into pieces small enough to be handled by power shovels and ore-crushing mills. The ore tends to break into blocks resembling quarry-stone. Many of these are so large that they have to be further broken by secondary blasting.

Reserves of magnetic taconite now being commercially developed in Minnesota have been estimated at about 5,000,000,000 tons from which about 1,700,000,000 tons of concentrates can be recovered. Taconite contains from 20 to 30 per cent of iron, compared with more than 50 per cent for the direct-shipping Lake Superior ores on which the U. S. steel industry principally relies.

The experiments were conducted on a taconite deposit near Mesabi, Minn., and in the Bureau's experimental hard-rock mine at Mount Weather, Va. Bureau engineers fired 168 experimental blasts, using different kinds and quantities of explosives different methods of firing, and different borehole patterns.

Prepared by Vernon C. Davis, former Bureau mining engineer, the report describes the characteristics of taconite, development of methods of mining it, factors on which the testing procedures were based, and the test site. It also includes detailed information on the various tests, and many photographs, diagrams and tables.

A free copy of Report of Investigations 4918, "Taconite Fragmentation," can be obtained from the Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pa. It should be identified by number and title.

AN ACCEPTED STANDARD FOR THE NEEDS OF INDUSTRY

Behind "Industrial" production you'll find modern equipment . . . engineering skill . . . craftsmanship . . . constant control . . . and large capacity.

We are specialists in cutting Gears, Sprockets, and Racks to serve machinery and equipment builders in all fields. Always specify "Durocase" Gears for Heavy-Duty or Steel Mill Service.

The quality we offer keeps assembly and maintenance costs low and assures dependable performance under the roughest conditions.

Send us your specifications for a prompt quotation on your requirements. Also write for Brochure "A Pictorial Trip Through Industrial."

MEMBER OF AGMA

Industrial Gear Mfg. Co.

4527 W. VAN BUREN ST.
CHICAGO 24, ILLINOIS

THE QUALITY OF SERVICE RENDERED BY...

...LEWIS ROLLS is recognized

by all practical rolling mill men

SUPERIOR "X" ROLLS
AJAX DUPLEX ROLLS
LEWIS "X" AND "XA" ROLLS
SPECIAL PROCESS ROLLS
CLIMAX AND AJAX ROLLS
PLAIN CHILLED IRON ROLLS
SPECIAL TUBE MILL ROLL
ATLAS, ATLAS "B" AND ATLAS "X" ROLLS
MOLYBDENUM CHILLED IRON ROLLS

MANUFACTURERS OF
ROLLS FOR THE IRON, STEEL AND
NON-FERROUS INDUSTRIES

may we have the opportunity of studying your requirements and submitting our recommendations

ROLLS DIVISION OF BLAW-KNOX COMPANY, PITTSBURGH, PA.

PLANS MODERN RESEARCH CENTER

▲ Westinghouse Electric Corp. has broken ground for the most modern research center in the electrical industry. Dr. John A. Hutcheson, Westinghouse vice president and director of research, turned the first shovelful of earth at a ceremony held on a 70-acre plot about 10 miles east of downtown Pittsburgh's Golden Triangle.

"When these new research facilities are completed early in 1955," Dr. Hutcheson said, "we will have the most modern research center in the entire electrical industry. The Westinghouse executive said construction of the research center will not only give current company research activities a new home but will also provide the necessary space and flexibility to meet the requirements "placed on us by the expansion program of Westinghouse and by the growing electrical industry."

The new research center will ultimately replace the present Westinghouse research laboratories located since 1916 only a few miles away from the new site. Of the present staff there only a small number will remain behind when it comes time for "the big move." For the time being, those who stay on at the old labs will continue research involving the use of special equipment such as that in the combustion laboratories, the 90-ton atom smasher and other equipment impractical to move. The giant, pear-shaped Van de Graaf generator, a familiar sight to motorists entering or leaving Pittsburgh's eastern city limits, will also remain at the old site.

INCREASES DEALER STAFF TO HANDLE ROSS LINE

▲ Clark Equipment Co. has revamped and expanded its dealer organization in the mid-west and on the west coast to handle its newly-acquired Ross straddle trucks and fork-truck lines. Clark Equipment Co. acquired Ross Carrier Co. in May, 1953.

The new dealer plan, to become effective on July 1, 1953, affects Clark dealer organizations in the states of California, Illinois, Indiana, Iowa, Michigan, Nebraska, Oklahoma, Oregon, and Washington. In most cases, existing Clark dealers will add Ross products to their regular sales and service activities.

Newly-appointed dealers who will handle the expanded Clark line include the Robert H. Dodd Equipment Co., Portland, Ore., and the Christy Equipment Co., Omaha, Neb.

Clark dealers who will sell and service Ross straddle trucks and fork-lift trucks include Glen L. Codman Co., Inc., San Francisco, and Robert H. Braun Co., Los Angeles, Calif.; R. E. Common Equipment Co., Peoria, Ill.; W. A. Marschke and Sons, Indianapolis and Materials Handling Corp., South Bend, Ind.; Big River Equipment Co., Davenport, Ia.; Morrison Equipment Co., Grand Rapids, Mich.; Arst Equipment Co., Tulsa, Okla., and Preston Faller, Seattle, Wash.

FOLLANSBEE PRODUCES PAN-FORMING MACHINE

▲ Follansbee Steel Corp. has announced the first production of a remarkable new pan-forming machine to be used with the company's popular seamless roll terne roofing.

The machine, which is portable and hand-operated, will turn up the edges of a 50-ft roll of terne in one minute flat. Estimated time for the same operation by conventional methods is thirty minutes.

Company officials stress that the machine is not only a timesaver, but a mansaver as well, since it takes the back-break out of one of the most tedious of the roofer's chores.

All the operator needs to do is to insert the continuous roll of metal at one end of the machine and thread it through a set of rollers. After that, the speed with which the pans are formed becomes simply a matter of how fast the operator wants to pull them through.

AGENTS APPOINTED BY POST-GLOVER

▲ Post-Glover Electric Co. announces the appointment of the following representatives in Buffalo, Cleveland, Philadelphia and Texas territories: Vincent J. Brown Co., 564 Ellicott Square, Buffalo 3, N. Y.; John L. Hutton Co., 4500 Euclid Avenue, Cleveland 3, Ohio; Linn O. Morrow & Son, Schaff Bldg., Philadelphia 2, Pa., Bill Richard, 1728 Bissonnet, Houston 5, Tex.

G-E ESTABLISHES NEW DEPARTMENT

▲ The establishment of a direct-current motor and generator department in the General Electric Co. has been announced by James M. Crawford, vice-president and general manager of the G-E motor and generator division.

Oscar L. Dunn, appointed general manager of the new department which will be located in Erie, Pa., explained that it will assume all duties and responsibilities of the company's former d-c motor and generator planning study.

In addition, he said, the department will have responsibility for the d-c and synchronous motor and generator lines which are now manufactured by the company's large motor and generator department at Fort Wayne, Ind., and the armored motor line produced at Erie by the medium induction motor department.

ANNOUNCES ADDITION OF NEW DISTRIBUTORS

▲ Rust-Oleum Corp., Evanston, Ill., announces the addition of two new industrial distributors to its nationwide distributor sales organization.

The newly appointed distributor firms are: Griswold-Sohl Automotive Co., 232 North Fourth Street, Columbus, Ohio; and Mill Supplies, Inc., Box 2762, Highway 82, East, Greenville, Miss.

J & L WILL ENLARGE OIL CITY TUBE PLANT

▲ Jones & Laughlin Steel Corp. has announced that it will enlarge the capacity of its Electricweld Tube division plant at Oil City, Pa. The expansion program will cost approximately $500,000.

It will result in an increase of approximately 50 per cent in the production of special fabricated tubing.

Construction of a steel building covering approximately 13,000 sq ft of floor space is expected to begin soon. It is expected that the new facilities will go into operation late this year.

TO CONSTRUCT ROD MILL AT CLEVELAND

▲ A major step in modernizing and expanding production facilities of American Steel & Wire Division of U. S. Steel Corp. in Cleveland, Ohio, was announced by Walter F. Munford, president of this division of United States Steel Corp.

A new rod mill will be constructed on properties of the present Cuyahoga Works on East 49th Street, south of Harvard Avenue, and will substantially increase the plant's rod production, as well as replace older equipment.

The new facilities, which will include a combination rod mill, billet storage areas, and rod storage areas, will have a rated capacity of 450,000 tons per year compared to the present equipment which dates back to 1916 and has a rated capacity of 313,000 tons a year.

"American Steel & Wire has been considering plans for this mill for several years in order to provide the highest quality product to its many rod and wire and wire products customers in Ohio, Michigan, parts of Indiana and Pennsylvania, and New York," Mr. Munford said. "Expansion of these facilities in Cleveland is only natural because of the great concentration of industries in Cleveland and Detroit which are using ever greater quantities of rod and wire and wire products. One of the major considerations given to the construction of this mill at this time is the important role it will play in helping serve the nation as a tool for national defense."

The new mill will incorporate the latest facilities, equipment and methods to effect maximum efficiency in production and further increase the quality of American Steel & Wire products.

Electronic and the latest automatic controls will be used extensively in the heating, working and cooling processes in the new mill to produce a quality product at mile-a-minute speeds.

Steel billets which must be heated before being rolled into rods will be conveyed through a huge furnace divided into multiple heat zones whose temperature will be closely controlled, much in the manner in which the housewife slowly roasts and then quickly browns a turkey.

The new facilities will handle billets 3¼ in. square and 30 ft long, weighing 1050 lb each. Presently billets weigh 600 lb.

Using a combination of reducing stands, the new mill is expected to send the rod speeding to the take-up reels at a rate in excess of sixty miles an hour. This is in contrast to present equipment where speeds range up to thirty-five miles an hour.

The reducing stands will be so arranged and equipped with finger tip controls and electronic measuring devices that the rod will literally "float" through the reducing mills. This will insure maximum accuracy in maintaining roundness and size of the product.

Rolling range of the new rod mills will be from No. 5 rod (which is about $\frac{7}{32}$ of an in.) to 1¼ in. Through use of the various stands available the mill will produce both fine and coarse rods in bundles up to 1050 lb in contrast to present-day bundles of 300 to 600 lb.

Billets for the new mill will be supplied principally from the Lorain, Ohio, works of the National Tube Division of U. S. Steel.

ACQUIRES CANADIAN ASBESTOS ORE DEPOSIT

▲ Purchase of a newly discovered asbestos ore deposit in northern Ontario as part of Johns-Manville's long range plan to maintain adequate reserves of asbestos ore, was announced recently.

The property is in Reeves Township in the same general area as Johns-Manville's Munro mine and mill, near Matheson, Ontario. The property was acquired as a result of Johns-Manville's exploration program which has been sharply accelerated since the end of World War II.

No plans have been made to establish production facilities on the new property as at the present time there is ample asbestos production capacity in Canada and in other areas of the free world.

INSUL-MASTIC ADDS TWO FIRMS AS AGENTS

▲ A western and a southern insulation contractor have accepted licensee contracts with the Insul-Mastic Corp. of America. The companies are: Starr Davis Co., Inc., Greensboro, N. C., and the Plant Asbestos Co., Emeryville, Calif.

Insul-Mastic produces heavy mastic coatings for the vaporsealing of insulation, for waterproofing masonry, and for corrosion prevention. The two contracting firms will act as applicators and distributors.

PRODUCE STEEL TIES FOR COTTON BALES

▲ Where cotton is "king," steel cotton ties are essential, and up to 75,000 tons of them are produced annually, according to American Iron and Steel Institute. These flat, pliant steel strips are used to hold cotton, compressed in bales to weigh 22 lb per cu ft or more. Baled cotton takes less than half the space in a freight car than it would occupy shipped loose.

Cotton ties are specially manufactured from hot rolled carbon steel strip. The strip is a little less than one inch wide and usually 0.042 in. thick (19 gage). As it leaves the finishing stand of the rolling mill at a speed of more than 30 mph, the cotton tie strip is approximately 3100 ft long. When the strip hits the end of the apron conveyor, it begins to fold on itself like so much ribbon.

From the apron conveyor, the strip is coiled and carried to a cold shear where it is cut into lengths of about 12 ft. These lengths are bundled by hand, about 30 strips and thirty little steel accessories called "buckles" to a unit. In a typical operation, these cotton tie bundles, each weighing about 45 lb, are suspended in racks and dipped in hot varnish or painted. Then they are taken to be stored in a warehouse until required for baling purposes.

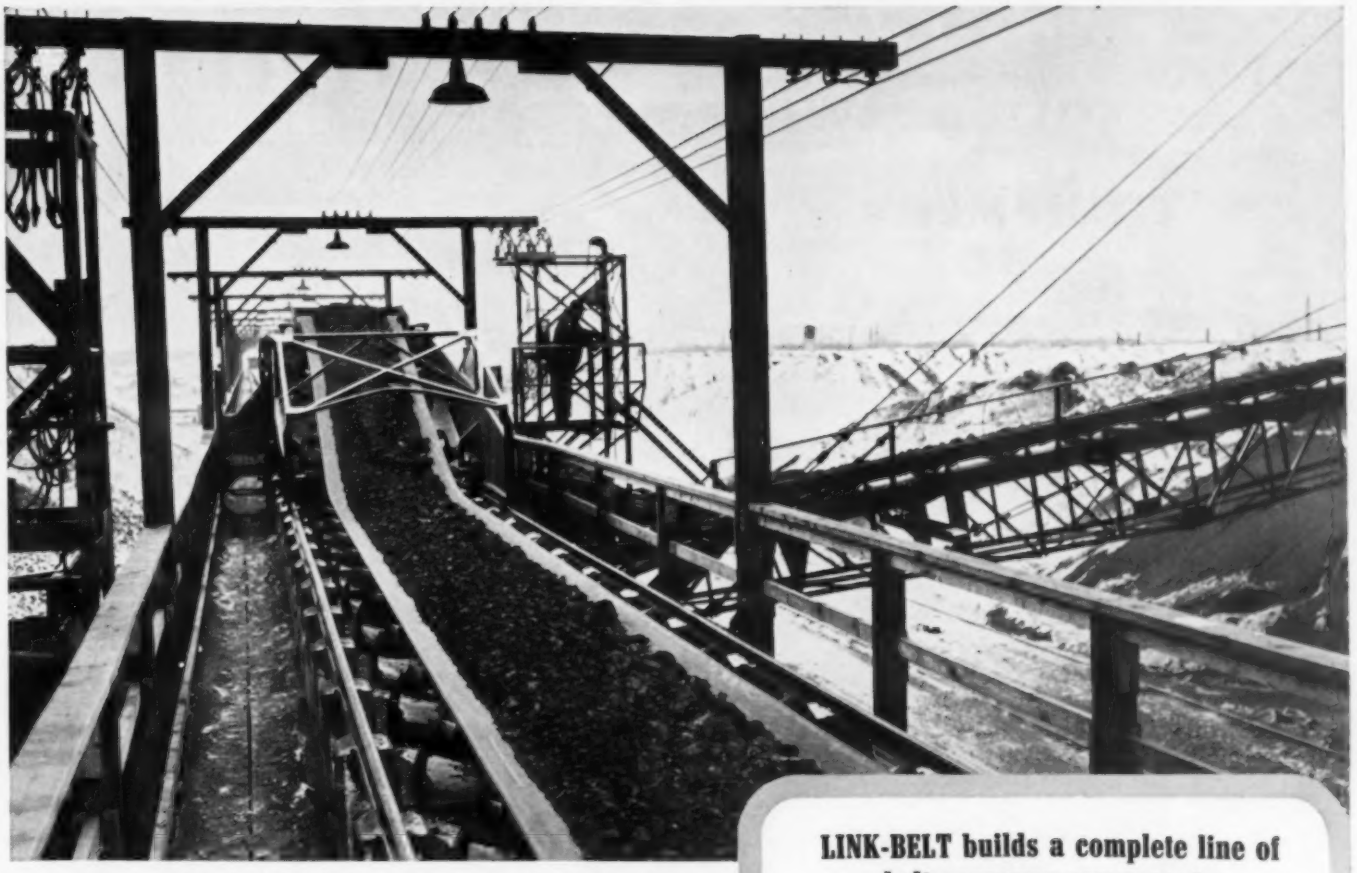
TIMKEN SHIPS LIBERIAN ORE TO CANTON PLANT

▲ A boatload of Bomi Hill iron ore, destined for Timken Roller Bearing Co. in Canton, Ohio, docked in Baltimore, Md., the end of June.

Purchased from the Liberian Mining Corp., the ten-thousand-ton shipment is comprised of high-grade iron ore containing 67 per cent iron. The ore will be shipped to Timken from Baltimore over the Baltimore and Ohio, Pennsylvania, and Nickel Plate Railroads.

A Timken official said that the Liberian ore is superior in quality and lower in price than Brazilian ore. The ten-thousand-ton iron ore order represents one year's supply for the Timken Roller Bearing Co.

TOTAL ENGINEERING



Steel mill employs Link-Belt belt conveyor system for transporting coal from ship unloading towers to dock storage. Here, Link-Belt tripper discharges 770 TPH of coal from 48-in. wide belt conveyor.

It's your assurance of top efficiency with LINK-BELT belt conveyors

HERE'S how "total engineering" works for you when you use Link-Belt Belt Conveyors. First, Link-Belt conveyor engineers analyze your needs—then recommend the *right* components. In addition, Link-Belt can supply all related equipment — other types of conveyors, feeders, elevators, car dumpers and shakers. And Link-Belt will build your supporting structures and enclosures . . . install the job completely, if desired. Call the Link-Belt office near you for any engineering assistance you need.

LINK-BELT

BELT CONVEYOR EQUIPMENT 13,280-C

LINK-BELT COMPANY: Plants: Chicago, Indianapolis, Philadelphia, Colmar, Pa., Atlanta, Houston, Minneapolis, San Francisco, Los Angeles, Seattle, Toronto, Springs (South Africa), Sydney (Australia). Sales offices in Principal Cities.

LINK-BELT builds a complete line of belt conveyor components

ALL TYPES OF ROLLER BEARING IDLERS

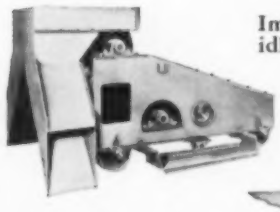
Return idler

20° troughed idler

Belt-training idler

Rubber tread return idler

Impact-cushioning idler



BELT AND MOTOR PROPELLED TRIPPERS

COMPLETE TERMINAL MACHINERY

Vaughn®

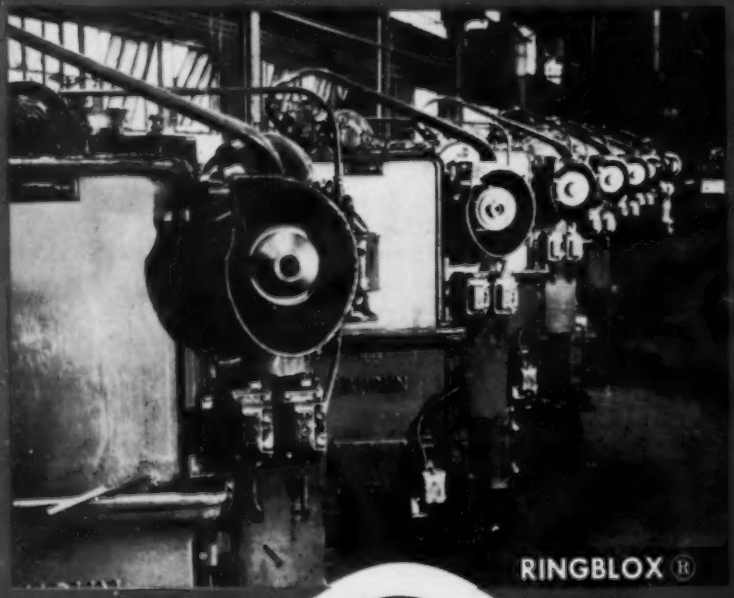
COLD DRAWING EQUIPMENT

-RIGHT

in types, sizes and capacities to profitably handle your jobs!

MOTOBLOC®

MOTOBLOX®



RINGBLOX®

DRAWBENCHES

"Quick on the Draw"

The Vaughn Machinery Co.

CUYAHOGA FALLS, OHIO, U.S.A.

COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

Announcing– the new LPD design **Clipper Oil Seal**

The design of the new LPD Clipper Seal assures that the spring which controls the lip contact on the shaft will be held tightly in the seal. It further provides a husky lip section that enables better control of lip flexing, and better utilization of the full available depth of the lip section.

. . . with reinforced heel developed especially for equipment used by the iron and steel industry

HERE IS THE newly designed Type LPD Clipper Oil Seal that lasts longer and seals more effectively than any previous design. It runs cool, sealing tightly even when shaft speeds are higher and equipment variables wide.

The new Type LPD Clipper Oil Seal can be supplied with the special reinforced heel developed to withstand the severe jolting of back-up roll bearing service. Thoroughly field tested, this special Clipper Seal is now being used with unusual success on hot and cold rolling mills, finishing trains, rod mills, wire mills and similar equipment.

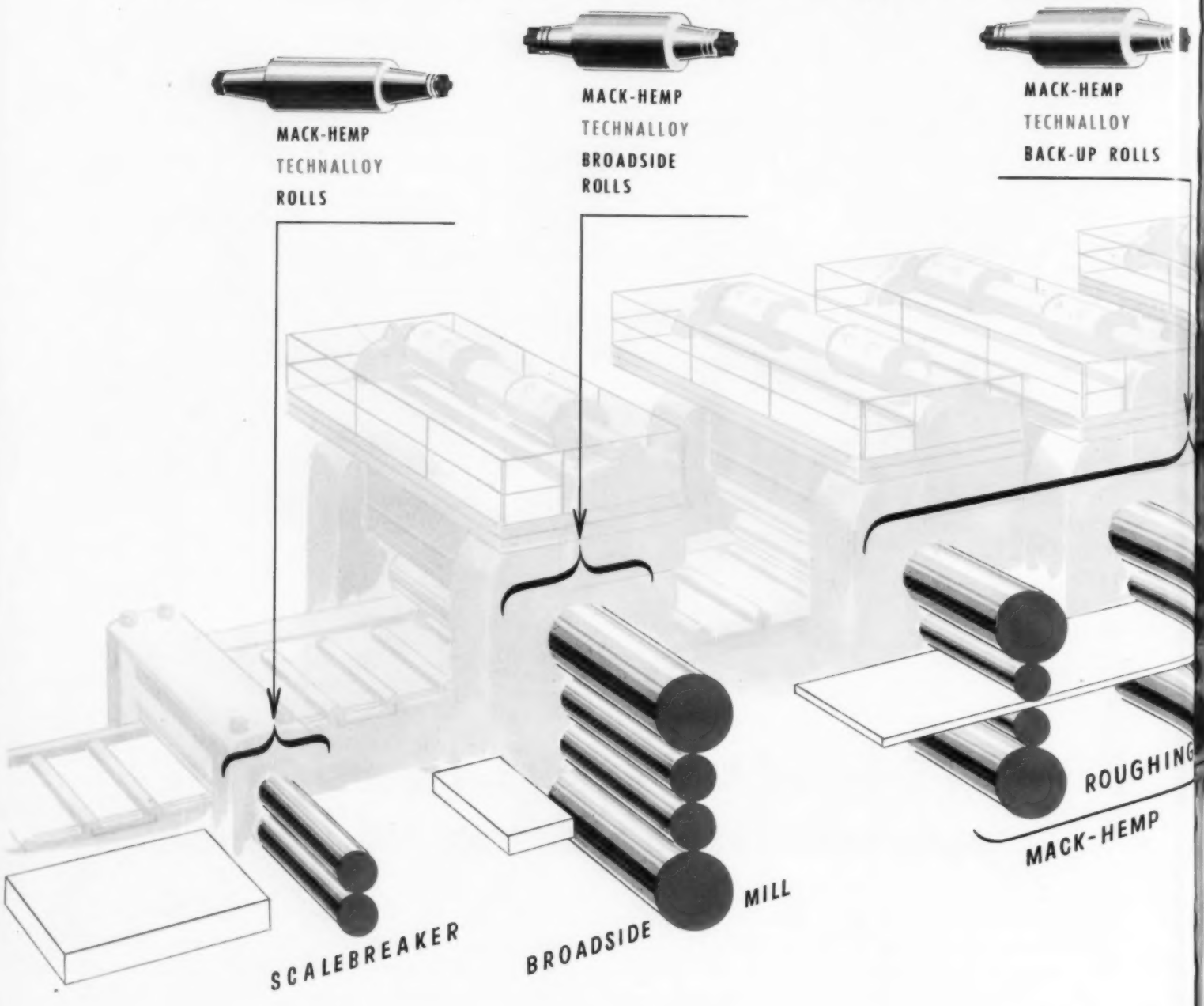
The longer life of this new Clipper Seal lessens replacements. It lasts longer and withstands higher shaft speeds because it requires less lubrication over its lip bearing area. Furthermore, the LPD design provides better utilization of the lip section of the seal—another factor in prolonging its life. And the greater flexibility of this lip section improves the performance of the seal.

• • •

For more information about the new Type LPD Clipper Seal with special reinforced heel, write Johns-Manville, Box 60, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS **Johns-Manville CLIPPER SEALS**

1953- Mack-Hemp's 150 Years of continuous product improvement



*Anniversary Roll is named in recognition of
MACK-HEMP's 150 Years of service
to the metals industry.

hot strip mill production rolls ahead when

MACKINTOSH-HEMPHILL COMPANY
PITTSBURGH U.S.A.

all stands are equipped with MACK-HEMP ROLLS

with the striped red wabblers

Put Technikrome work rolls in the roughing stands, Special Nironite "F" rolls in intermediate stands, Anniversary Rolls in the first three finishing stands, and regular Nironite "F" rolls in the rest of the finishers; back them up with Technalloy or Midland Special rolls, and watch the excellent production records these Mack-Hemp Rolls make for you.

The superior performance records of Mack-Hemp Rolls *with the striped red wabblers* reflect the help that your roll designers and mill operators have given Mack-Hemp metallurgists.

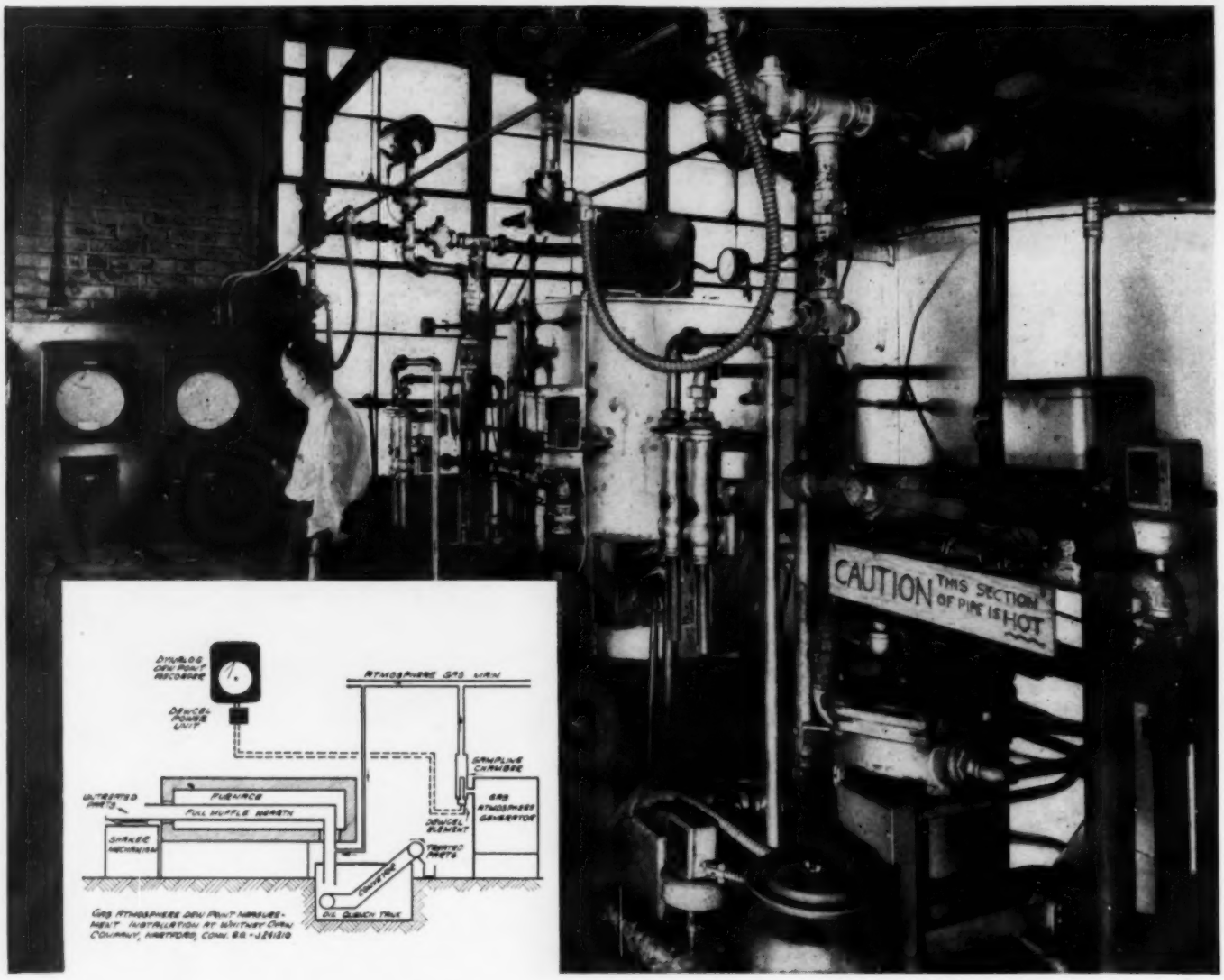
Because we are always working to improve our Rolls *with the striped red wabblers*, it pays to keep your eye on what's new and different at Mack-Hemp.

MACKINTOSH-HEMPHILL COMPANY

PITTSBURGH AND MIDLAND, PA.

Makers of the Rolls with the Striped Red Wabblers

MACKINTOSH-HEMPHILL PRODUCTS INCLUDE: rolls . . . steel and special alloy castings . . . completely integrated strip mills . . . heavy duty engine lathes . . . Mackintosh-Hemphill rotary straighteners . . . improved Johnston patented corrugated cinder pots and slag-handling equipment . . . shape straighteners . . . end-thrust bearings . . . shears . . . levellers



How Whitney Chain Improved Heat Treating with **DEWCEL*** Moisture Measurement

Whitney Chain Co., in Hartford, Conn., uses two Gas-Atmosphere Generators to supply a battery of heat treating furnaces in producing chain plates, pins, rollers, and bushings for their Power Transmission and Conveyor Chains. Correct atmosphere conditions in the furnaces must be maintained for proper carbon control and retention of finish on these hardened and carburized parts.

Formerly it was necessary to make complicated time-consuming spot checks of these conditions. Now, *Foxboro Dew Point Recorders* monitor continuous samples of the gas from the generators . . . provide continuous dew point records which permit the operator to maintain desired gas quality.

The heart of this precise measuring system is its humidity-sensitive element — the exclusive Foxboro Dewcel which senses the dew point temperature to within ±1° F. . . . rapidly responds to any change in moisture content. Complete illustrated description of the Foxboro Dew Point Recording System is contained in Engineering Data Sheet 340-7. Write for copy.

*Trade Mark

THE FOXBORO COMPANY, 587 NEPONSET AVE., FOXBORO, MASS.

FOXBORO
REG. U. S. PAT. OFF.

INSTRUMENTS that Improve Product Quality

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

SAFETY DISCONNECT SWITCHES for A-c and D-c Cranes

SAFETY FOR EQUIPMENT — These switches meet crane specifications for disconnect means on footwalk and in crane cab. Only one unit to install—push button permits disconnecting the crane from the cab in an emergency.

High interrupting capacity—built to withstand crane service—no delicate parts to loosen under vibration.

EASIER FOR OPERATORS — Positive closure to "full-on" position magnetically—so easy a child can operate it. Pulling handle down opens holding circuit; manual follow-up by roller on handle-shaft forces contacts open if contactors fail to drop-out. Proof against accidental closure, too.

Auxiliary contacts for signal lights—provision for padlock—front-connected leads—large wiring space. This switch simplifies the spare-part problem since parts are of crane control design. Tops in *safety* and *convenience*.

WRITE FOR BULLETIN 1024 ON MANUAL-MAGNETIC DISCONNECTS

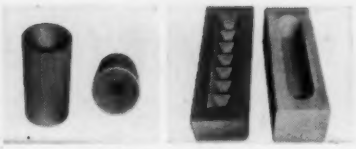
1024

E&M

THE ELECTRIC CONTROLLER & MFG. CO.

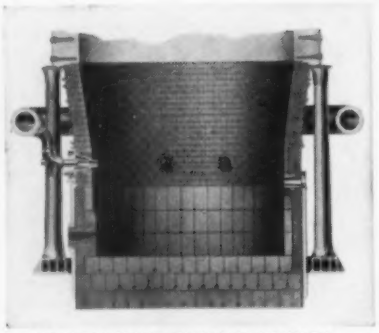
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

GRAPHITE CRUCIBLES



GRAPHITE MOLDS

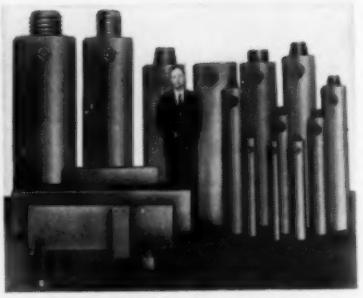
GRAPHITE SINTERING BOATS & TRAYS



CARBON BLAST FURNACE LININGS

GET MORE TONNAGE FOR LESS

WITH THESE



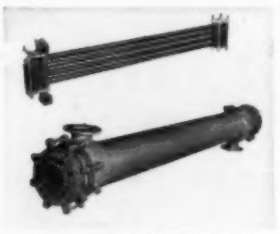
CARBON & GRAPHITE ELECTRIC FURNACE ELECTRODES

GRAPHITE FLUXING TUBES

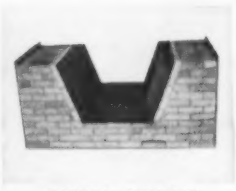
NATIONAL

TRADE-MARK

Carbon and Graphite Products



"KARBATE" IMPERVIOUS GRAPHITE HEAT EXCHANGERS



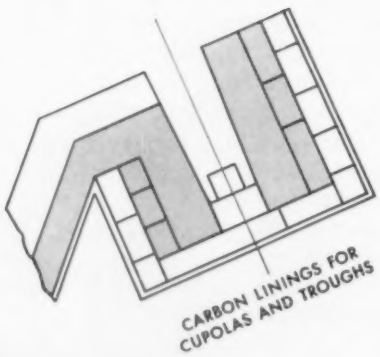
CARBON LININGS FOR RUN-OUT TROUGHS

"KARBATE" IMPERVIOUS GRAPHITE PLATE HEATERS AND CARBON TANK LININGS

CARBON CINDER NOTCH LINERS

NO OTHER MATERIAL PROVIDES THIS COMBINATION OF PROPERTIES!

- **Chemically inert**
- **Does not melt**
- **Low coefficient of thermal expansion**
- **Good thermal conductivity**
- **Excellent electrical conductivity**
- **Non-contaminating**
- **Resists wetting by molten metal and dross**



CARBON LININGS FOR CUPOLAS AND TROUGHS

The terms "National" and "Karbate" are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street, New York 17, N. Y.

District Sales Offices: Atlanta, Chicago, Dallas Kansas City, New York, Pittsburgh, San Francisco

IN CANADA:

National Carbon Limited, Montreal, Toronto, Winnipeg

CARBON BRICK

SOME OTHER NATIONAL PRODUCTS

CARBON LININGS FOR FERRO-ALLOY FURNACES • CARBON MOLD PLUGS • GRAPHITE THERMOCOUPLE SHEATHS • GRAPHITE STARTERS FOR HOT-TOPPING • CARBON CINDER NOTCH PLUGS • GRAPHITE AND CARBON CORES • GRAPHITE RISER RODS • CARBON BOXES AND GRAPHITE POWDERS FOR HEAT-TREATING • PIPE AND FITTINGS • CARBON BRICK • PUMPS • CONDUCTOR ROLLS • SPECTROSCOPIC ELECTRODES • STEAM JETS • ANODES

Personnel News...

Barney Dagan, formerly general superintendent, has been named works manager of the Fontana plant of Kaiser Steel Corp. In taking over this position, Mr. Dagan will also be responsible for duties previously administered by him as general superintendent.

Harry A. Fohl, manager, maintenance and construction division at Lukens Steel Co., Coatesville, Pa., has turned over active direction of the division to **Reuben G. Uhler,** present superintendent of the mechanical department. **Malcolm B. Antrim,** superintendent of the electrical department, has become assistant manager of the maintenance and construction division.

Max D. Howell was elected executive vice president of American Iron and Steel Institute, New York, N. Y. Mr. Howell has been executive director and treasurer of the Institute. **B. F. Fairless,** chairman, United States Steel Corp., and **Ben Moreell,** chairman of Jones and Laughlin Steel Corp. were elected vice presidents. **George S. Rose** was re-elected as secretary. **C. M. Parker** was elected to the newly created position of assistant vice president of the Institute. **E. O. Sommer, Jr.** was elected treasurer of the Institute. **John W. W. Sullivan** has been appointed metallurgical engineer of American Iron and Steel Institute, New York, N. Y., succeeding Mr. Parker. Mr. Sullivan became a member of the Institute staff in 1945.

Raymond M. Dennis, manager of fabrication at the by-products division of Lukens Steel Co., retired June 30 after 28 years of service with the company. **William D. Taylor,** present assistant manager of fabrication, advanced to the vacated post. **R. Russell Fayles,** superintendent of refractories and fuel department was assigned as staff assistant to Mr. Taylor. Mr. Fayles will retain his department superintendency while discharging his new duties.

Matthew A. Carpenter has been elected chairman of the executive committee of Falk Corp., Milwaukee, Wisc. Mr. Carpenter has been associated with the company since 1924. He created and developed the company's sales program, establishing Falk sales offices throughout this country and in foreign industrial centers. **Harold F. Falk** succeeds Mr. Carpenter as executive vice president. Mr. Falk joined the company in 1933. He has served as general superintendent, works manager and most recently vice president — manufacturing. **Louis W. Falk,** formerly vice president, engineering, is now vice president — manufacturing. Former chief engineer **Walter P. Schmitter** has been appointed vice president — chief engineer.

Dr. L. I. Gilbertson has been appointed director, in charge of the Murray Hill, N. J. laboratories of Air Reduction Co., Inc. He was administrative manager at that location. **Dr. G. B. Carpenter** has been named manager of the development staff with headquarters in New York. He was formerly manager, chemical division at the Murray Hill laboratories. **Dr. A. Muller** was appointed director of metallurgical research. He was formerly manager, metallurgical division. **Dr. B. C. Redmon,** formerly with U. S. Industrial Chemicals Co., has been appointed director of chemical research.

Wilbur T. Blair was named vice president and treasurer of the Sharon Steel Corp., Sharon, Pa. Prior to joining Sharon Steel, Mr. Blair was associated with the Cincinnati branch of the Federal Reserve Bank in Cleveland, Ohio, for eight years, having held the positions of assistant secretary, secretary, counsel and vice president. He was appointed vice president in charge of the Cincinnati branch, January 1, 1953.

Prior to his connection with the Federal Reserve Bank, Mr. Blair was associated with the law firm of Manchester, Ford, Bennett & Powers in Youngstown, Ohio, and during World War II was connected with the Cleveland Ordnance District of the War Department, performing legal functions and later participated in renegotiation activities.

Robert L. Orth was appointed field sales manager, after 14 years' service as district manager in the Detroit, Mich., sales office for American Wheelabrator and Equipment Corp., Mishawaka, Ind. **Julius E. Skene** was advanced to manager of customer service, and

BARNEY DAGAN

HARRY A. FOHL

REUBEN G. UHLER

MALCOLM B. ANTRIM

Philip R. Jordan was promoted to chief sales engineer. **Gordon R. Bryant** was promoted to district manager of the Detroit office. **John W. Swantz,** formerly of the firm's Chicago, Ill., office, joined the Detroit office as a district sales engineer, and **Erwin C. Shepard** was added as a service engineer. **F. H. Toman** was appointed district sales engineer to replace Mr. Swantz in the Chicago office. He was formerly district service engineer in the Toronto, Ontario, Canada, office. **J. Douglas Lamb** was appointed district service engineer for the Toronto office. **Wilfred G. Carrie** was named district manager of the Seattle, Wash., office. He was formerly a home office project engineer in the company's dust and fume control division. **George C. Tolton,** former Seattle district manager, has been appointed district manager of the Greensboro, N. C., branch.

Frank X. Gilg was named executive assistant in the boiler division of Babcock & Wilcox Co.

James P. Williams was appointed an assistant general superintendent of Kaiser Steel Corp., Fontana,

JAMES P. WILLIAMS

Calif. Mr. Williams joined the company in 1945, coming from Geneva Steel division of U. S. Steel Corp., Provo, Utah, where he had been plant industrial engineer.

Neil Franklin Meredith has joined Basic Refractories, Inc., Cleveland, Ohio, as technical assistant to the vice president in charge of operations and engineering. Mr. Meredith was formerly ceramic engineer for the AC Spark Plug Division of General Motors Corp., where he engaged in research, production control and personnel work.

J. A. Shimmin has been named vice president of operations for Rotary Electric Steel Corp., Detroit, Mich.

A. W. Plier was named president and general manager of the D. J. Murray Manufacturing Co., Wausau, Wis. Mr. Plier succeeds **F. C. Boyce** who has been president since 1933 and is now chairman of the board.

E. E. Moore was appointed assistant to president and vice president of U. S. Steel Corp., Pittsburgh, Pa. Mr. Moore has been U. S. Steel's vice president, industrial relations — administration. Mr. Moore joined U. S. Steel in 1919 at Gary, Ind., where he secured employment as a construction machinist in the plant

E. E. MOORE

of the American Sheet and Tin Plate Co. Since that time, Mr. Moore's extensive experience in U. S. Steel has included management responsibilities in the Roll and Machine Works in Canton, Ohio and the Shenango Works at New Castle, Pa. In 1926 he returned to Gary, Ind., to become assistant manager in charge of construction and operation of U. S. Steel's first wide four-high hot and cold strip mills. In 1932, Mr. Moore became assistant to the vice president of the Illinois Steel Co. and upon the formation of Carnegie-Illinois Steel Corp. in 1935 he was made general superintendent of its South Steel Works in Chicago, Ill. Three years later he became general superintendent of the Gary Steel Works and in 1940 was transferred to Pittsburgh as vice president, industrial relations.

Harry W. Hudson was named general superintendent of the Ellwood City, Pa., works of National Tube

HARRY W. HUDSON

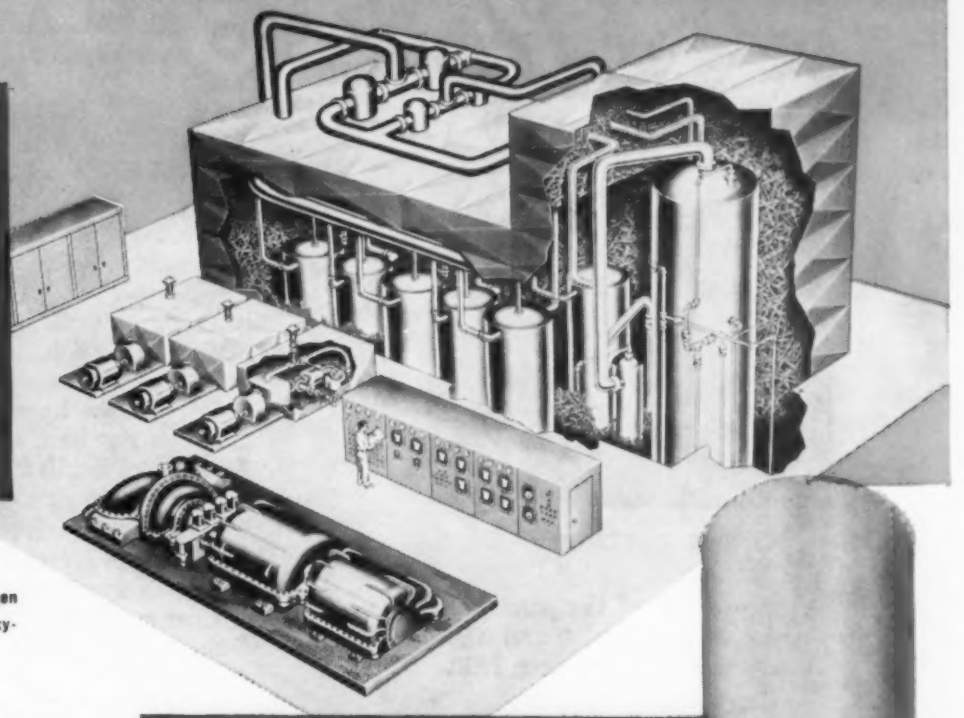
division of the U. S. Steel Corp. Mr. Hudson, who has been assistant general superintendent at Ellwood Works,

Use the free air to make your own

LOW COST OXYGEN and NITROGEN

2-in-1 *Tonnage* GENERATORS

Standard models with oxygen capacities to 1000 TONS PER DAY Nitrogen capacities larger



A typical Air Products Tonnage Oxygen-Nitrogen Generator in operation since February, 1951. Oxygen capacity, 450 tons per day.

AIR PRODUCTS TONNAGE GENERATORS for oxygen, nitrogen *unlimited!* Standard models or specially designed. High or low pressure cycles according to requirements. Generators for production of oxygen and nitrogen, gas or liquid, in virtually *any* quantity, of *any* purity and at *any* pressure.

AIR PRODUCTS HIGH-PURITY GENERATORS slash oxygen costs *and* inert gas costs. Make *both* with *one* generator—produce super high-purity oxygen and nitrogen *simultaneously* or individually. Make *what* you want *when* you want it: compressed oxygen, high or low pressure nitrogen, liquid oxygen, liquid nitrogen.

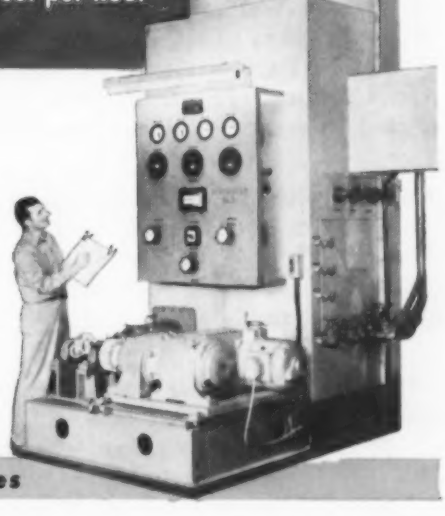
What are your requirements? Write to

AIR PRODUCTS, INCORPORATED
Dept. P, Box 538, Allentown, Pa.

2-in-1 *High-Purity* GENERATORS

OXYGEN to 99.9% Purity
Capacities to 12,000 cubic feet per hour

NITROGEN to 99.99% Purity
Capacities to 36,000 cubic feet per hour



Air Products
INCORPORATED
OXYGEN-NITROGEN
GENERATORS

Specialists in Gas Separation by Low-Temperature Processes

succeeds **Paul F. Mumma** who became general superintendent of the division's Gary, Ind., plant.

M. B. Terry has been appointed president of American Brakeblok Division of American Brake Shoe Co. He was formerly executive vice-president of this division. Mr. Terry succeeds **W. T. Kelly, Jr.,** who continues as a vice-president of the parent company and president of the Kellogg Division and who has served as head of American Brakeblok since 1950.

M. B. TERRY

D. E. Inman has been appointed engineering manager of general industrial products for Westinghouse Electric Corp., East Pittsburgh, Pa. Mr. Inman goes to his new assignment from the Westinghouse Chicago, Ill., office where he had been district engineering and service manager for the company's northwestern district since July, 1949. In his new position, he will exercise staff supervision and coordinate the engineering activities of the general industrial products divisions.

F. H. Atwood was elected president of Refractories Institute, a national trade association of producers of fire brick and other refractory products, at the annual membership meeting on June 12 held at the Seaview Country Club, Absecon, N. J. Mr. Atwood is vice-president in charge of personnel and assistant chief counsel of Harbison-Walker Refractories Co., Pittsburgh, Pa. **W. A Turner,** president of McLain Fire Brick Co., Pittsburgh, Pa. was re-elected treasurer of the Institute. **J. L. Crawford** of St. Louis, Mo., retiring president, was elected an honorary associate member.

R. B. Nichols, president and general manager of the Bantam Bearings Division of Torrington Co., South Bend, Ind., has been elected president of the Anti-Friction Bearing Manufacturer's Association for a one year term.

Hugh D. Luke, for the past five years associated with McKinsey and Co., Boston, Mass., management consultants, has been named manager of the newly established central production planning department of Reliance Electric and Engineering Co., Cleveland, Ohio. **James A. Brandt** has been named assistant manager of the department. **A. S. Tusin,** resident engineer responsible for statistical quality control development and performance since mid-summer of 1947, was promoted to superintendent. **Robert B. Adams,** production manager for nearly three years, becomes night superintendent. **Henry C. Dettenmayer,** since February staff assistant to the vice president of manufacturing at Cleveland, now is production manager at Ashtabula, Ohio.

Charles W. Cravens has been named open hearth superintendent of Republic Steel Corp's Cleveland, Ohio, steel plant. Succeeding him as assistant superintendent of the open hearth and electric furnace shop at Republic's South Chicago, Ill., plant is **Erwin F. Franzen.** Mr. Cravens succeeds **Robert P. Carpenter,** who recently was appointed superintendent of the company's Massillon, Ohio, plant. In 1947, Mr. Cravens was appointed assistant superintendent of the South Chicago open hearth and electric furnace shop. Mr. Franzen has been serving as senior melter of electric furnaces at South Chicago since 1945.

Edward A. Ulvestad has been named director of purchases of Kropp Forge Co., Chicago, Ill. Mr. Ulvestad was formerly purchasing agent of Kropp Forge Ordnance Co., Melvindale, Mich., a subsidiary of the firm.

J. M. Van Winckle has been appointed chief engineer, Montreal office of the Quebec Iron and Titanium Corp. He will be located at the Sorel works of the company in Montreal, Canada.

Harold C. Lindberg has been named manager of engineering for the newly established Empire sales district of General Electric Co. with headquarters at 113 South Salina St., Syracuse, N. Y. Mr. Lindberg has been office engineer for G-E in the Buffalo, N. Y., office since 1946. Until his recent appointment Mr. Lindberg has served as Buffalo district section secretary of the Association of Iron and Steel Engineers.

HAROLD C. LINDBERG

Tube Mill Practice

A selection of articles
from the
IRON AND STEEL ENGINEER
on various phases of
tube making.

Practical information on layout and operation of facilities for seamless, butt and electric weld pipe, a field in which little information has been published . . . 23 articles by 20 authoritative writers . . . invaluable for engineers, operators, trainees and students.

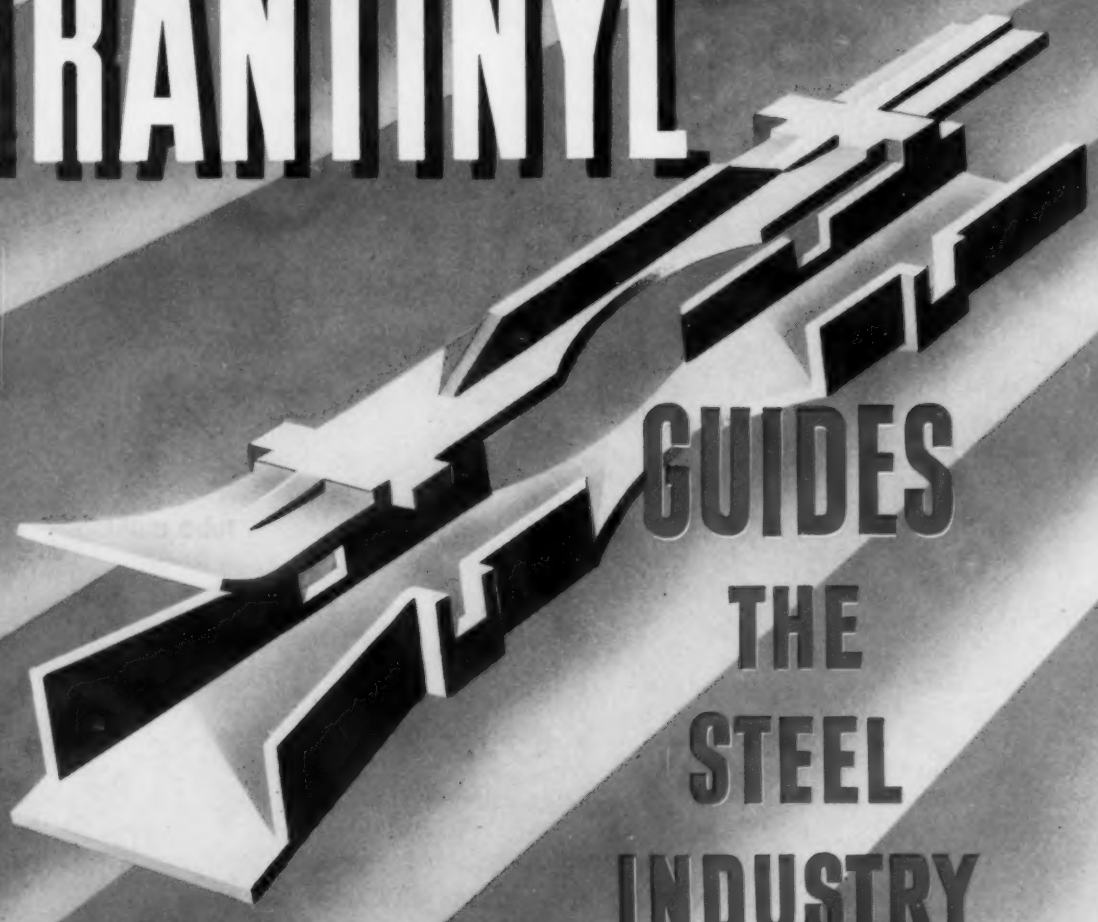
8-¼ x 11-¼ in., ... 196 pages, illustrated, clothbound

Price: To AISE Members . . . $2.00
To Others $4.00

ASSOCIATION OF IRON AND STEEL ENGINEERS

1010 Empire Building
Pittsburgh (22), Pa.

TRANTINYL



GUIDES THE STEEL INDUSTRY

New

TRANTINYL *NO. 1 CASTINGS

Shaped to individual specifications

APPLICATIONS: CAMS • GUIDES • ROLLS and ROLLERS
MANDRELS • SPINNING TOOLS • WEARING PLATES • ETC.

DIES: can, forming, blanking, ceramic, drawing, extrusion, swaging.

CAST TO SHAPE COMPONENTS FOR THE MASS PRODUCTION OF DURABLE GOODS

SPECIAL PURPOSE CASTINGS TO MEET YOUR NEEDS.

***HIGH CARBON HIGH-CHROMIUM STEEL**

YOUNGSTOWN ALLOY CASTING CORP. • YOUNGSTOWN, OHIO

C-9

HARRY T. GRAHAM

WALTER F. CARTER

CARL W. SISCO

H. H. GORRIE

Harry T. Graham, has been named vice president of General Refractories Co., Philadelphia, Pa. Serving as general sales manager until his recent promotion, he will continue to be active in supervision of the sales group in addition to his new administrative duties. **Richard E. Longacre,** has stepped up to general sales manager of the company. **Herbert F. Greene** has also been elected a vice president, effective immediately. His former position with the refractories manufacturing organization was that of works manager. In his place, **Gordon C. Fay** has been selected to take the position of works manager.

Walter F. Carter was appointed assistant general superintendent of Acme Steel Co.'s Riverdale, Ill., plant. In addition, Mr. Carter retains his duties as director of technical services.

Carl W. Sisco has been named sales engineer for the Toledo, Ohio, district of the steel mill division of Surface Combustion Corp. Mr. Sisco replaces **Frank J. Winder** who has retired after 31 years of service with the company. Mr. Sisco has been associated with Surface Combustion Corp. in various engineering capacities for the past 17 years. For the past several years, he has specialized in the application of electrical and combustion control equipment to the steel mill furnaces.

H. H. Gorrie, assistant chief engineer of Bailey Meter Co., Cleveland, Ohio, has been appointed chief engineer, directly in charge of the company's engineering activities.

T. M. Stonerod was appointed assistant to the vice president — sales and head of Brooks Oil Co.'s coal mine division. Mr. Stonerod has been a sales engineer for Brooks for the past 13 years, and previously was superintendent of the Shenango Furnace Co. mine at Ligonier, Pa.

Edward G. Buschow has been elected president and manager of sales engineering of Fab-Cor, Inc. Mr. Buschow was associated with Surface Combustion Corp. for 28 years, having progressed through all departments of its main office and was most recently district manager in charge of industrial sales of its Pittsburgh, Pa., office. Fab-Cor, Inc., whose offices are located in the Grant Building, Pittsburgh, Pa., is engaged in developing, designing, and manufacturing industrial devices and machinery, as well as special metallurgical furnaces, ovens, and combustion systems.

Paul F. Mumma was named general superintendent of the Gary, Ind., works of National Tube Division of U. S. Steel Corp. Mr. Mumma has been general superintendent of the Ellwood City, Pa., works of National Tube. He succeeds **W. A. Jayme,** who has been assigned to other duties.

R. M. Junker has been appointed manager of the newly combined departments of tank lining and industrial roll sales in Goodyear Tire & Rubber Co.'s industrial products division at Akron, Ohio. Mr. Junker has been serving as manager of industrial roll sales since 1948.

Douglas B. Martin was elected vice president in charge of sales of the Amplex Division of Chrysler Corp., Detroit, Mich. **Karl H. Kuhlen** was appointed sales manager of the division. Mr. Martin has been associated with Amplex for 20 years, and since 1945 has been sales manager. Mr. Kuhlen has been assistant sales manager of Amplex since 1950.

Richard S. Copeland, superintendent of transportation at Lukens Steel Co., Coatesville, Pa., since 1939, retired June 30 because of ill health. **Newton J. Thompson,** present assistant superintendent, was promoted to the superintendency. A departmental realignment will send **Ralph C. Hertzler** from the transportation department to the machine and forge department where he will continue to supervise the maintenance of all internal combustion equipment.

Walter A. Mosteller has been appointed manager — sales for the Michigan district of General Electric Co.'s Apparatus Sales Division. Mr. Mosteller, formerly manager — product sales, will complete his thirtieth year with the company this summer.

T. W. Lasiewicz has been added to the Cleveland-Buffalo territorial staff of Askania Regulator Co. in

association with **C. E. Hague** and **Hugh N. Helm.** Mr. Hague has been the Askania representative in the Cleveland territory for the past twenty years and Mr. Helm has been established as service engineer for the past five years. Mr. Lasiewicz has been Askania's sales representative in the Chicago-St. Louis area for several years. The new Askania office will be located at Room 428 Union Building, 1836 Euclid Avenue, Cleveland 15, Ohio.

William R. McCalister was appointed assistant general superintendent, Gary, Ind., works of National Tube Division of U. S. Steel Corp. Since 1951 Mr. McCalister has been serving as superintendent of the hot mills at Ellwood City, Pa., works.

Harry C. Slagle, manager of Aluminum Co. of America's Chicago, Ill., works, has been transferred to Pittsburgh, Pa., as manager of Alcoa's shop training program. He will be succeeded by **R. E. Sheffer,** staff assistant to the general manager of the company's fabricating division.

M. L. Hiller, who has been a field engineer in the Washington, D. C. district office of Elliott Co., has now been appointed district manager, replacing **S. K. Hostetter, Jr.,** who is now sales manager of the Ampere, N. J. plant.

Bernard Anscher has been appointed sales manager for domestic sales of Hydropress, Inc., New York, N. Y., and its Loewy Rolling Mill Division.

T. S. Fuller has been appointed consultant for the research and metallurgical departments of Heppenstall Co., Pittsburgh, Pa. Mr. Fuller recently retired after 42 years' service for the General Electric Co. at Schenectady, N. Y.

Robert J. Simes has been promoted to the position of superintendent of the mechanical department at Lukens Steel Co., Coatesville, Pa. Mr. Simes, has been assistant superintendent of the mechanical department since December 1950.

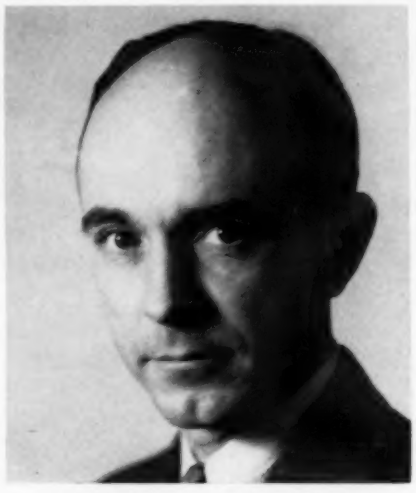
Douglas S. Birgfeld has been appointed a sales engineer in the Philadelphia, Pa., district office of Electro Dynamic Division, General Dynamics Corp.

William B. Crump was named sales engineer in charge of the Detroit, Mich., office of May-Fran Engineering, Inc. Mr. Crump will represent May-Fran's line of materials handling equipment and mechanized scrap handling systems in that city.

Charles H. Evans and **Paul H. Magnus, II,** were elected as vice presidents of Rosedale Foundry and Machine Co., Pittsburgh, Pa.

Frederick W. Seitz is now secretary-treasurer of Brooks & Perkins, Inc., Detroit, Mich., fabricators and processors of magnesium metal. **Charles D. Smith** has come from U. S. Steel Corp., where he was superintendent of the rolling mill at Donora, Pa., to become works manager of B&P's mill division at Livonia, Mich. **Edward H. Perkins,** a metallurgical engineer, is moved to Detroit from the B&P New York office to manage the newly-established commercial division. Prior to joining B&P, he was a sales engineer for the Aluminum Co. of America.

J. S. Freese, production manager of the Steel and Tube Division of Timken Roller Bearing Co., Canton, Ohio, has been promoted to the post of assistant general production manager of the company. Succeeding Mr. Freese to the post of production manager of the Steel and Tube Division is **Robert J. Townsend.** Mr. Townsend has been serving as assistant production



ROBERT J. TOWNSEND

manager since 1942. **Ralph A. Boyd** has been promoted to the post of assistant production manager of the Steel and Tube Division. **Wilfred G. Herbert** has been promoted to the post of production manager of the bearing division of all Timken plants. Succeeding Mr. Herbert to the post of production manager of the Canton bearing factory is **Charles L. Richey.** Mr. Richey advanced to the position of assistant production manager in 1946.

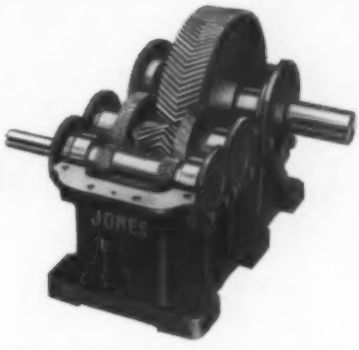
John R. Longenecker has been appointed Pittsburgh, Pa., district representative for C. M. Kemp Manufacturing Co., of Baltimore, Md. Mr. Longenecker succeeds the late **John P. Flippen.**

Walter H. Zollinger, chief engineer, manufactured products, Bethlehem Pa., plant, Bethlehem Steel Co., has retired after more than 36 years of service.

M. J. Fey was appointed executive engineer of Nichols Wire and Aluminum Co., Davenport, Ia. Mr. Fey has been associated with the Nichols Co. for 30 years.

E. C. Clark, assistant director of the research and engineering department, has been appointed director of operations, Air Reduction Sales Co. **L. B. Dobbins,** works manager of Airco's liquid oxygen plant at Butler,

One of two new Allis-Chalmers kilns at Basic Refractories Inc. Maple Grove, Ohio plant. Dual drives engineered by Allis-Chalmers Mfg. Co. and W. A. Jones Foundry & Machine Co.



Driving a non-stop giant size rotary kiln calls for PLUS PERFORMANCE

That's why Basic Refractories selected JONES HERRINGBONE GEAR SPEED REDUCERS to drive two new rotary kilns — the largest in the world's refractory industry — at their Maple Grove, Ohio dolomite processing plant.

Operations at Basic are continuous. In processing, dead burned dolomite must be constantly *ON THE MOVE* — a drive failure could result in serious damage from the hot mixtures in the kiln.

Naturally, Basic Refractories' engineers took utmost care in the drive component selection for this important application. And, naturally, they chose JONES HERRINGBONE GEAR DRIVES because of their proven ability to stay on the job and take the 'round-the-clock, day-in and day-out punishment of continuous operation.

Giving PLUS PERFORMANCE under these and similar conditions is nothing new for any type Jones Speed Reducer — all are recognized and accepted throughout industry for all sorts of applications demanding rugged dependability, maximum capacity and quiet, smooth, power transmission.

BIG DRIVES — SMALL DRIVES — You may not have a giant kiln to drive; but when you have a power transmission job, big or small or anything in-between, your best answer is JONES . . . it has been for over 60 years.

W. A. JONES FOUNDRY & MACHINE CO. 4431 West Roosevelt Road, Chicago 24, Illinois

Ask for Catalog 70

Since 1890 . . . In the Service of Industry

Jones

HERRINGBONE — WORM — WORM HELICAL — GEAR SPEED REDUCERS
CAST IRON PULLEYS • CUT GEARS • V-BELT SHEAVES
ANTI-FRICTION PILLOW BLOCKS • FLEXIBLE COUPLINGS

Pa. has been appointed manager of plant engineering, New York, N. Y., replacing **R. E. Lenhard** who is being transferred to the Ohio Chemical and Surgical Equipment division of Air Reduction, Madison, Wis., as vice-president — manufacturing.

Robert S. Dunseath was appointed sales manager of Plasteel roofing and siding in the New Jersey area

ROBERT S. DUNSEATH

for Plasteel Products Corp. of Pittsburgh and Washington, Pa.

Edward A. Parker was named assistant superintendent of Kaiser Steel Corp.'s plate and hot strip mills at Fontana, Calif. Mr. Parker was previously affiliated with Youngstown Sheet and Tube Co. at East Chicago, Ind., from 1939, where he was roller in the 54-in. hot strip mill.

Harold Bongarten has been appointed superintendent of the General Electric Co.'s apparatus service shop in Detroit, Mich. Mr. Bongarten will replace **Arthur D. King,** who will assume charge of the Cleveland, Ohio, service shop.

Jesse J. Baum has been appointed supervisor of American Cast Products, Inc., Orrville, Ohio, subsidiary of Hagan Corp.

Dr. John M. Parks has joined the staff of the research laboratories of Air Reduction Co., Inc., at Murray Hill, N. J., as manager of the metallurgical process division. Dr. Parks goes to Air Reduction from the Armour Research Foundation of the Illinois Institute of Technology, Chicago, Ill.

Charles L. Garrettson has been appointed manager of industrial relations by Air Products, Inc., of Allentown, Pa.

R. F. Crawford has been named staff supervisor of employment for Armco Steel Corp., with offices at Middletown, Ohio and **E. C. Huselton** has been appointed staff employment advisor. Mr. Huselton will move to Armco's general office from the Butler, Pa. division of the company, where he has been employment advisor.

W. S. Carlson has been appointed manager of the Minneapolis district office of Elliott Co. located at 540 Plymouth Building, Duluth, Minn. **H. D. Mateffy** has been appointed branch manager of the Duluth office of Elliott Co.

Harvey V. Eastling was named assistant general manager of the Pacific division of Link-Belt Co. with headquarters at San Francisco, Calif. Mr. Eastling, had been general sales manager for the Pacific division. **Donald E. Thal** was made sales manager of the San Francisco plant. Mr. Thal has more recently served as assistant sales manager at San Francisco.

A. M. McIntyre has been named district manager of Electric Controller and Manufacturing Co.'s newly opened office at 1133 S. Brentwood Blvd., St. Louis, Mo. **Joseph M. Hyland** has been appointed to the New York, N. Y., sales office, following a year's training at the Cleveland, Ohio home office of EC&M. **C. B. Chapman, Jr.,** has been transferred to the Detroit, Mich., office, after serving in EC&M's Chicago, Ill., office for several years.

Frank W. Wehrheim has been appointed general sales manager of Appleton Electric Co., Chicago, Ill. Since January, 1952, Mr. Wehrheim has been sales manager of the Electrical Fittings Division.

Daniel C. Wing was appointed sales engineer for Appleton Electric Co., Chicago, Ill. Mr. Wing will work in the New England area.

Newbold C. Goin has been appointed sales manager for Lombard Corp., Youngstown, Ohio. Mr. Goin was formerly executive secretary of American Gear Manu-

NEWBOLD C. GOIN

facturers Association and prior to that time was with the gear division of Westinghouse Electric Corp.

William T. Welch has been elected president of Ajax Flexible Coupling Co., Westfield, N. Y. Other

(*Please turn to page 176*)

PHOENIX "A" BACK UP ROLLS are color marked for specific uses in rolling . . .

HOT AND COLD STRIP MILLS AND PLATE MILLS

PITTSBURGH ROLLS

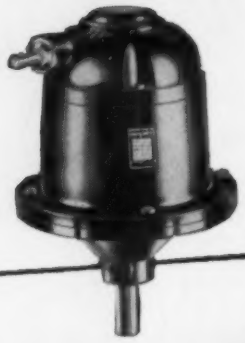
BLAW-KNOX COMPANY • PITTSBURGH ROLLS DEPARTMENT • PITTSBURGH, PA.

OTHER PITTSBURGH ROLL TYPES

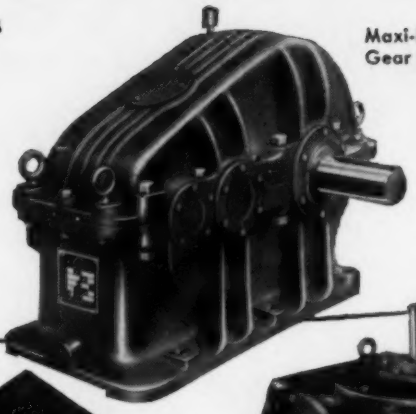
- Chill
- Moly Chill
- Special Rail Finishing
- Phoenix "K"
- Pittsburgh Grade 25
- Pittsburgh Grade 35
- Pittsburgh Grade 45
- Pittsburgh Grade 55
- Pittsburgh Grade Special Process
- Phoenixloy
- Phoenix Metal
- Phoenix Metal Master
- Carbon Steel
- Phoenix "A" Alloy Steel
- Phoenix "A" Special Alloy Steel

P.R.W.

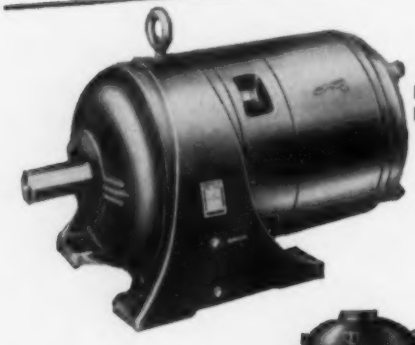
Line-O-Power
Straight Line Drive
(Foot Mounted)



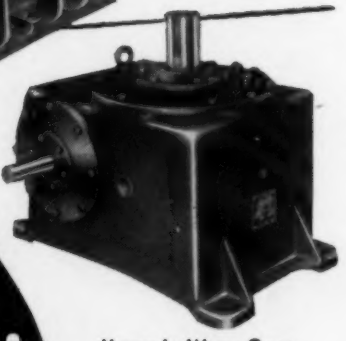
Line-O-Power Right Angle
Drive (Flange Mounted)



Maxi-Power Helical
Gear Drive



Foote Bros.-Louis Allis
Horizontal Gearmotor



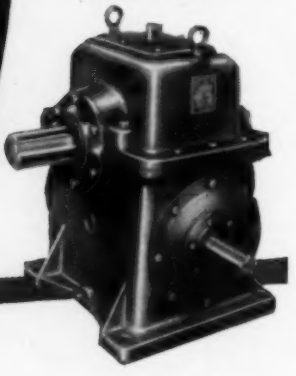
Hygrade Worm Gear
Vertical Drive

name your job...

FOOTE BROS. DRIVES WILL HANDLE IT!

Foote Bros.-Louis Allis
Vertical Gearmotor

Hygrade Worm Gear
Horizontal Drive



Worm-Helical Gear
Drive

At Foote Bros. you will find a complete line of enclosed helical and worm gear drives for every job. Ratios and capacities to answer every speed reduction need. Also available to assure long and satisfactory service is a complete line of Foote Bros.-Louis Allis Gearmotors, both vertical and horizontal.

Foote Bros. offers these advantages: Nearly 100 years of design, engineering and manufacturing experience—the latest in gear-cutting techniques—better control of materials. Modern production techniques at three large plants assure superior drives for every power transmission requirement.

Mail coupon for information.

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION
4545 South Western Boulevard, Chicago 9, Illinois

Foote Bros. Gear and Machine Corporation
Dept. IAS, 4545 South Western Boulevard
Chicago 9, Illinois

Please send me information on the following:

☐ Line-O-Power Drives ☐ Maxi-Power Drives
☐ Hygrade Drives ☐ Worm-Helical Gear Drives
☐ Foote Bros.-Louis Allis Gearmotors

Name.....

Company.....

Address.....

Position.....

City.....*Zone*.....*State*.....

Oil Immersed
mechanically interlocked power outlet

Type 620-A3GX Safety Switch with Receptacle and Plug Interlock — Closed view and with oil tank lowered showing arrangement of component Parts.

A SAFETY POWER outlet to provide dependable operation under adverse conditions and convenience for readily connecting portable equipment such as welding machinery, conveyors, mixers, agitators, etc. Manually operated, mechanically interlocked switch handle and plug makes it impossible to insert or remove the plug while the switch is in the closed position.

Standard features of the Rowan Type 620-A-3GX Safety Switch include the following: completely oil immersed; manually operated disconnect switch of the quick-acting contactor type with renewable contacts; equipped with ROWAN time-tested AIR-SEAL fuses; sealed-off terminal compartment; safety disconnect jack; straight through conduit entrance; provision for padlocking switch in the OFF position; enclosure designed to meet the requirements of NEMA Type XI — also available for NEMA Type VIII, Class 1, Group D locations, designated Type 620-A-1-3GX.

Complete information available from Rowan representative in principal cities of the United States.

ROWAN CONTROL
THE ROWAN CONTROLLER CO., BALTIMORE, MD.

(*Continued from page 172*)

officers elected were: **Wayne Belden,** executive vice president; **Charles Belden,** vice president; **H. E. Northrop,** treasurer; and, **Robert G. Cady,** secretary.

Charles M. Heath was named assistant to the director of industrial relations at the Fontana, Calif., works of Kaiser Steel Corp. Mr. Heath joined Kaiser Steel in 1950 as attorney for the Fontana works.

J. P. Holt, sales engineer, will direct the newly opened sales office of Basic Refractories, Inc., in St. Louis, Mo. Before joining Basic Refractories in 1950, he served as superintendent of melting at Midvale Co., Nicetown, Philadelphia, Pa.

Carl J. Westling has been appointed director of engineering for Salem-Brosius, Inc., Pittsburgh, Pa., and will be in charge of the centralization of all engineering activities, including research and development. Mr. Westling was formerly chief engineer.

Gordon E. Medlock, formerly assistant sales manager, has been appointed sales manager of Stearns Magnetic Inc., Milwaukee, Wisc. Associated with the company since 1946, Mr. Medlock will be responsible for the sales of the company's complete line of magnetic separation and power transmission equipment.

Donald C. Starr was appointed secretary and comptroller of Chemsteel Construction Co., Inc., Pittsburgh, Pa. Mr. Starr goes to Chemsteel from the Pittsburgh office of Price Waterhouse & Co., where he was a senior accountant.

Howard G. Grim was named general manager of operations and **Paul H. Daley** assistant general manager of operations for Heppenstall Co., Pittsburgh,

HOWARD G. GRIM

Pa. In their new responsibilities, the men will coordinate the operations of the company's steel forging plants at Pittsburgh and New Brighton, Pa.

Thomas J. Manning was named district manager of the Cincinnati, Ohio, office of Okonite Co. Mr. Manning has been associated with Okonite as a sales engineer in the Birmingham, Ala., district office since 1946.

Lucien W. Moore, director of purchases for Crane Co., Chicago, Ill., was elected vice president and **George L. Larson,** general superintendent of the company's Chicago Works, was appointed executive assistant

Obituaries

Walter H. Beyerle, 67, formerly assistant electrical superintendent of the Sparrows Point, Md., plant of Bethlehem Steel Co., died June 5. Mr. Beyerle, who

WALTER H. BEYERLE

retired in August 1951, had been with Bethlehem Steel Co. since 1909. He served as chairman of the Philadelphia District Section of the AISE for 1942-43.

Pierre I. Chandeysson, 77, founder and president for 50 years of the Chandeysson Electric Co., St. Louis, Mo., died June 5 in St. Louis.

Russell J. Greenly, 58, assistant director of personnel relations, Jones & Laughlin Steel Corp., Pittsburgh, Pa., died June 25.

R. Leslie Beattie, 62, vice president and general manager of Canadian operations of International Nickel Co. of Canada, Ltd., died June 10.

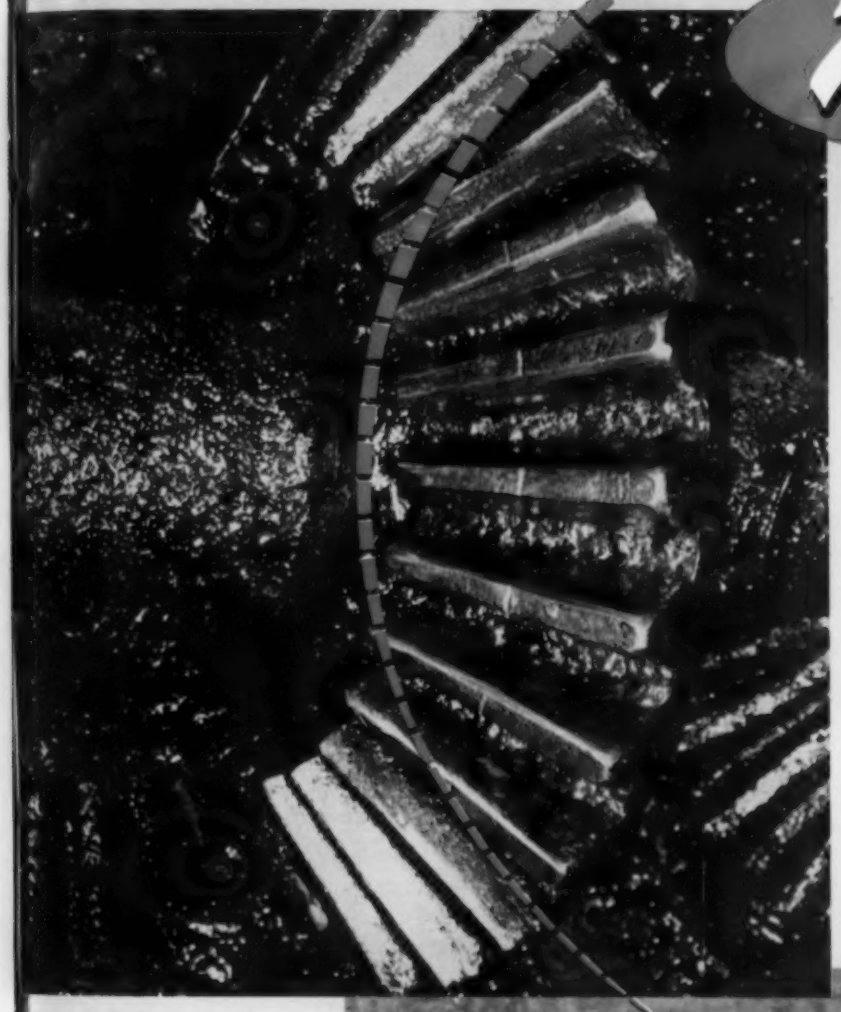
Lucian F. Adams, 58, auditor for Dravo Corp., Pittsburgh, Pa., and its subsidiary, Fulton-Portsmouth Bridge Co., Portsmouth, Ohio, died June 27.

Harry A. Pastre, 80, retired vice president of the Elliott Co., died May 25. Mr. Pastre was associated with W. S. Elliott even before the latter founded the company in 1901, and he became Elliott Co.'s first salesman. In 1935 he became a vice president of the company and he retired in 1943.

take a good look at these

TSP

bevel gears



. . . in operation at Crucible Steel's Midland, Pa. Plant on the exit end of a 2-High Reserving Mill.
HARDLY WORN AT ALL . . . but they've already lasted 5 times longer than bevel gears formerly used!

Here's why: "Tool Steel Process" Bevel Gears are made of low carbon alloy steel. File hard wearing surfaces are backed by a tough ductile core, resulting in super resistance to wear and fatigue.

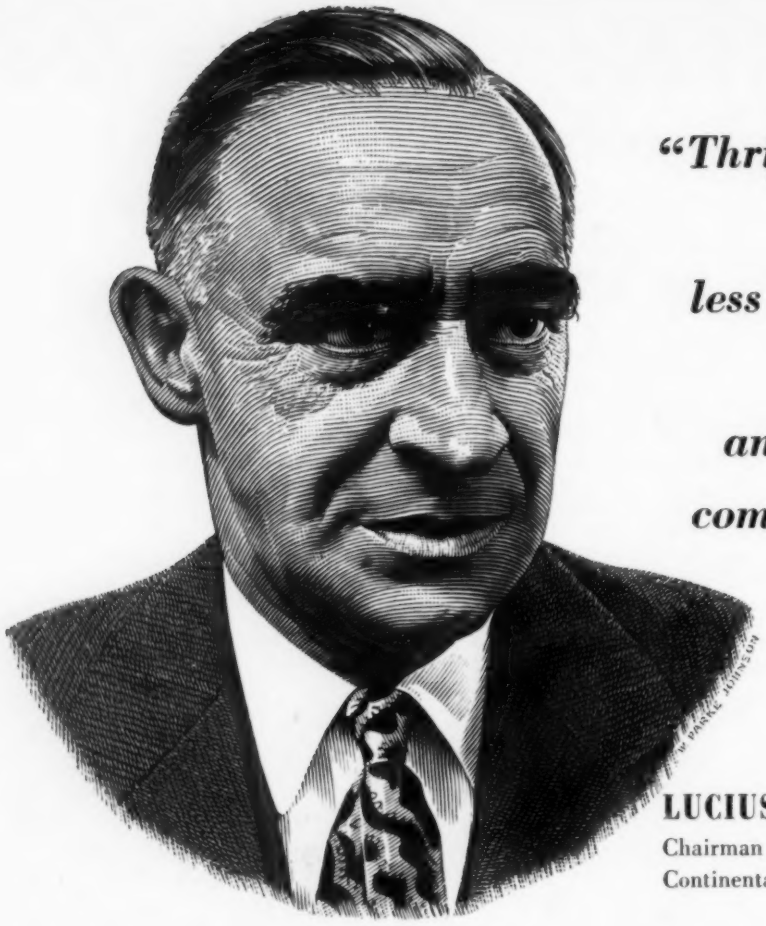
Specify "Tool Steel Process" Products today. Write for Bulletin

THE TOOL STEEL GEAR AND PINION CO.
CINCINNATI 16, OHIO, U. S. A.

No. 1003

You receive an absolutely positive written GUARANTEE that TSP Products will give a longer life in the same service than any other product.

The Standard of Quality Since 1909 for Gears • Pinions • Rolls • Wheels and Other Hardened Products



"Thrifty citizens . . . with Savings Bonds . . . less likely to be taken in by the false promises and ideologies of communist propagandists . . ."

LUCIUS D. CLAY
Chairman of the Board
Continental Can Company

"The regular purchase of Savings Bonds through the Payroll Savings Plan by millions of our citizens contributes importantly to the country's economic stability, the national defense effort, and to the financial independence of the individual. The thrifty, self-reliant citizen is one far less likely to be taken in by the false promises and ideologies which communist propagandists invariably direct to the 'have nots'."

• To thousands of company executives, accountants, payroll department employees, PSP means Payroll Savings Plan, the simple payroll allotment operation through which employees make a monthly investment in U. S. Savings Bonds.

• To almost eight million employees of nearly 50,000 companies, PSP has a more intimate connotation. To them, PSP spells *Personal Security Plan.*

• Multiply the personal security of a single Payroll Saver by 43,000,000—the number of individuals who hold Savings Bonds having a cash value of $49.5 billion—and you have economic stability that is the keystone of our national defense.

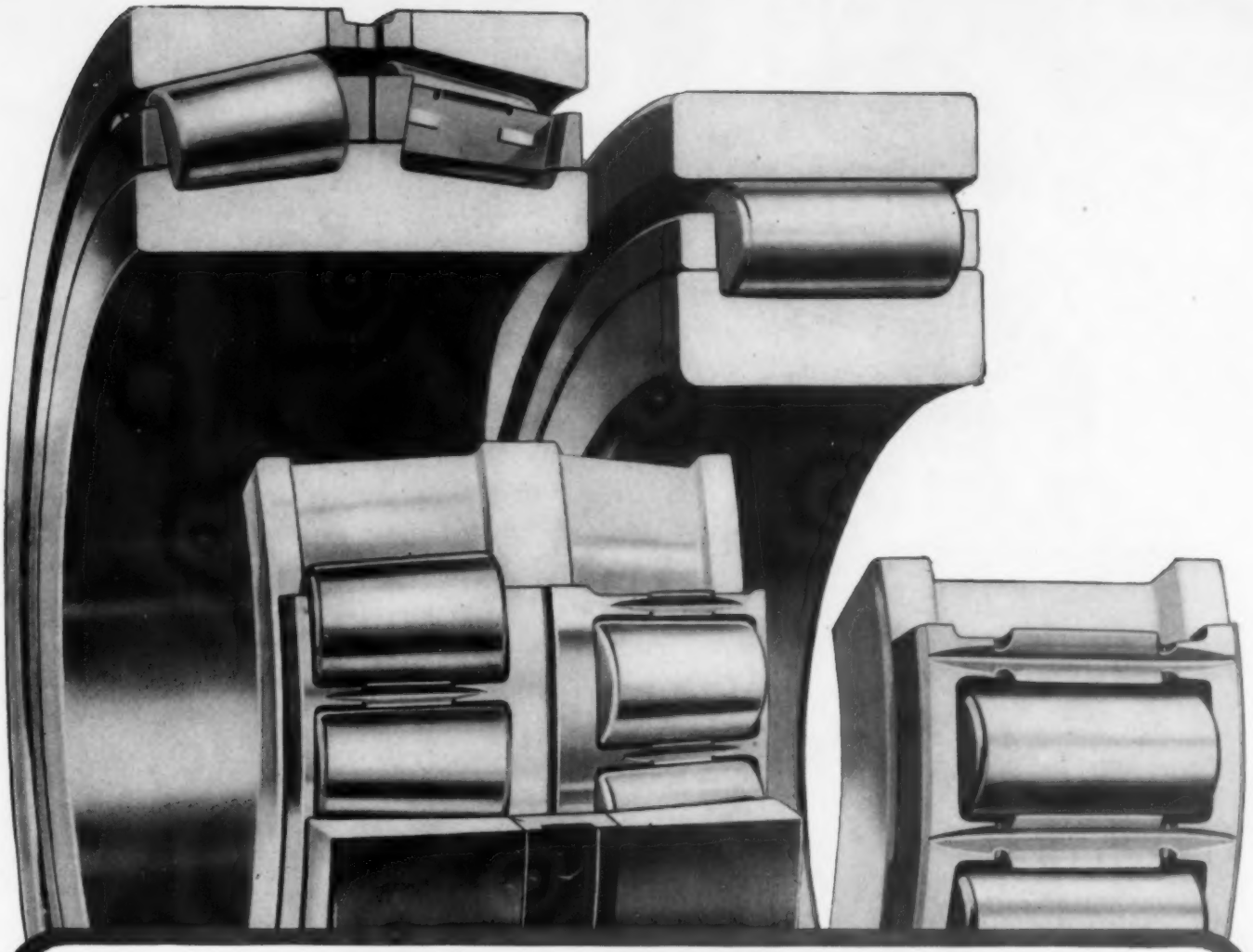
• Thanks to the thousands of companies which offer their employees the Payroll Savings Plan, Bill Brown in the Machine Shop . . . Joe Green in the boiler room . . . and eight million more Browns and Greens can well turn a deaf ear to ". . . the false promises and ideologies . . ." of communist propagandists. Bill can see his new home taking shape in his growing stack of Savings Bonds . . . Joe sees each bond another step toward a college education for little Joe . . . and the "Old Timer," who eats his lunch with Bill, talks of "sitting down pretty soon" because his Bonds will make a nice addition to his Social Security.

• PSP holds still another benefit—this one for the employer. Payroll Savers are conscientious workers. Statistics show that absenteeism goes down, production improves and accidents decrease as payroll participation goes up.

• If employee participation in *your* Payroll Savings Plan is less than 50%—or if your company does not have a Payroll Savings Plan—get in touch with Savings Bond Division, U. S. Treasury Department, Washington Building, Washington, D. C. Learn how easy it is to help your country, your employees and your *company*—through the PSP.

The United States Government does not pay for this advertisement. It is donated by this publication in cooperation with the Advertising Council and the Magazine Publishers of America.

IRON AND STEEL ENGINEER



TORRINGTON

TAPERED and CYLINDRICAL ROLLER BEARINGS

Give you these BIG ADVANTAGES

- **One-piece cast-bronze cages with machined pads in each roller pocket**—to assure accurate guiding of rollers.
- **Stabilized races**—to maintain accuracy of fit, improve bearing performance.
- **Individual roller retainment**—to assure adequate lubrication at roller, simplify inspection of race surfaces.
- **Precision tolerances and finishes on both rollers and races**—for minimum eccentricity and equal load distribution.
- **Controlled quality steels**—by use of electric furnace steels, through-hardening or case-hardening grades, and modern heat-treating methods—for increased bearing capacity and longer life.
- **Interchangeability**—in all types and sizes.

Backed by custom engineering to meet your load and speed requirements, these advantages add up to maximum performance for your bearing dollar. That's why it always pays to specify TORRINGTON!

THE TORRINGTON COMPANY

South Bend 21, Ind. • Torrington, Conn.

TORRINGTON BEARINGS

Spherical Roller • Tapered Roller • Cylindrical Roller • Needle • Ball • Needle Rollers

PRESS BUILDER USES Trabon SYSTEMS FOR POSITIVE LUBRICATION

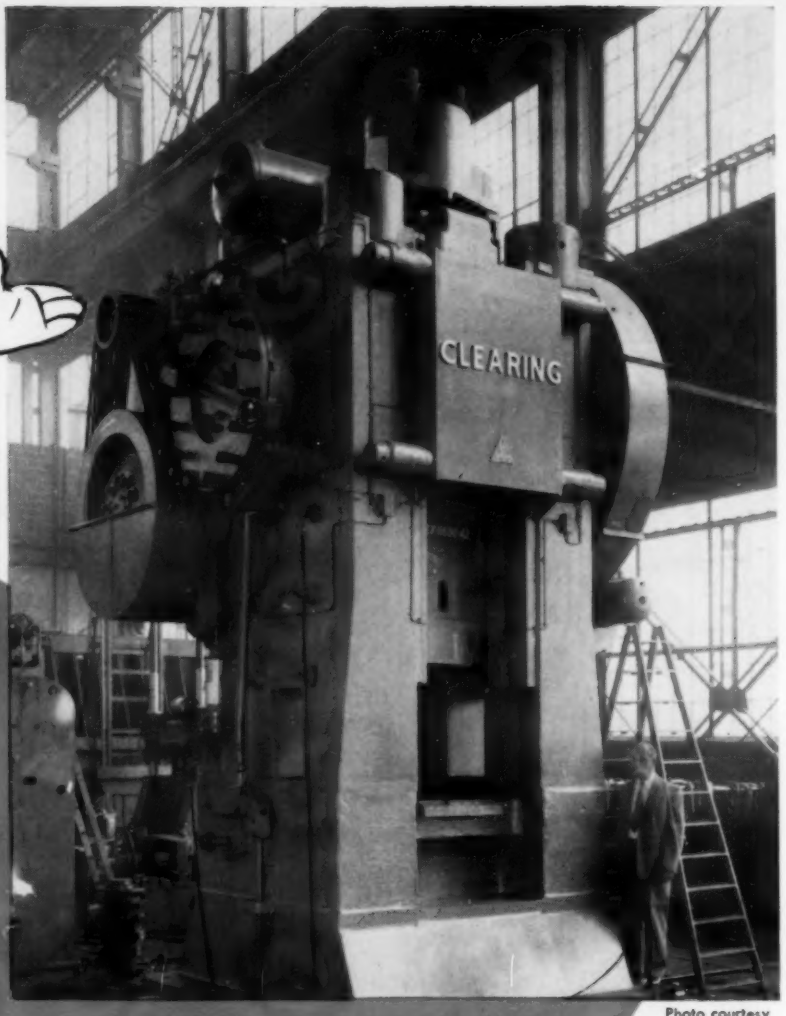


Photo courtesy Clearing Machine Corp., Chicago

this has a BEARING on the subject

TRABON *automatic* lubrication on this Clearing forging press lubricates 36 bearing points while the press operates under full load. This completely trouble-free system has eliminated bearing burnouts and costly shutdowns.

A TRABON system on *your* metal-working, metal-producing equipment will do the same job efficiently, economically and positively.

Remember, it's impossible to under-lubricate or skip a bearing with a TRABON positive system . . . a single indicator at the pump tells the operator when every bearing is properly lubricated.

Fully hydraulic . . . economical . . . for oil or grease . . . safe . . . completely sealed.

There are more Trabon Automatic Lubrication Systems in use than all other makes!

Write for Bulletin No. 529

Trabon ENGINEERING CORPORATION
1814 E. 40th STREET • CLEVELAND 3, OHIO
Oil and Grease Systems

Equipment News...

INTER-COM SYSTEM

▲ Farmers Engineering and Manufacturing Co. has announced a new inter-communication system known as the "Femco Pagephone." These systems provide inter-office or inter-plant telephone communication coupled with unique "all-hear" paging features.

The method of installation, and all equipment, has been designed for simplicity and flexibility.

One centrally located amplifier replaces the usual numerous master stations and one common cable serves the entire system. Plug-in junction boxes make possible the addition or deletion of stations without interruption of service.

Equipment consists of a centrally located Pagephone amplifier, junction box, handset stations and a single, inter-connecting cable. Each station consists of a telephone type handset, loudspeaker, volume control and an indicator light which shows whether or not the system is clear for use.

To call another person, a user removes the handset from its hook, presses the handset button to page and speaks the name of the person wanted into the mouthpiece. With a natural voice volume, page calls are clearly audible over every station in the system. The person being called may answer from any station and then converse privately exactly as if a telephone conversation had been made. A telephone conference held by several persons may be announced and carried on in the same way.

Paging may be done from any station without the use of a central operator. But, in addition, a "super-page" feature permits a central operator, who may be a receptionist or telephone switchboard operator, to make page calls and announcements while the system is in use, without cutting off handset conversations.

This equipment is available for standard duty, heavy duty and mill duty. Standard duty equipment for offices includes the familiar telephone type handsets for desks or wall mounts. Heavy duty stations are constructed of heavy gage steel and are recommended for store rooms, power stations and light manufacturing. The mill duty stations, housed in cast iron enclosures, are water-tight and dust-tight and meet all the requirements of heavy industry.

Installations can be made anywhere in business or industry, from office to office, office to shop, building to building or floor to floor. Any number of independent systems may be inter-connected together. In general, a single amplifier will handle up to 20 stations. For noisy locations or where additional stations are required, booster amplifiers are available.

Wiring required between stations is one communication cable, $\frac{3}{8}$ in. diameter, consisting of two pairs of wires with either one or both pairs shielded. The handset stations are wired in parallel to the common cable.

SPEED REDUCERS

▲ Two worm gear speed reducers, which are undoubtedly among the biggest in the giant class of worm gear speed reducers, were recently designed and manufactured by De Laval Steam Turbine Co.

This pair of giants will drive transfer conveyors for the continuous and rugged service of moving heavy steel slabs. They will be installed in a new 45-in. universal slabbing-blooming mill being built by the Mesta Machine Co. for a large steel plant.

The slab transfers, which the De Laval worm gear units will drive, are designed to convey steel slabs up to 12 in. thick and 42 in. wide, weighing over 55,000 lb.

These worm gear units, with a reduction ratio of $26\frac{2}{3}$ to 1 in a single set of gearing, are each driven by a 200 hp, 410 rpm, motor coupled directly to the input shaft. The output shaft in turn is coupled to a separately supported sprocket shaft. The sprocket operates a chain equipped with dogs which gage the steel slabs and transfer them from one point to another. Shock loading occurs as a dog engages each slab.

In designing the gearing, top quality materials were selected for the components. The worm is made of a nickel alloy steel forging and the worm threads were carburized to provide a hard yet tough surface to withstand wear. High grade chill cast nickel bronze was selected for the gear to provide a material compatible with that of the worm. In designing this gearing, it was necessary to take into consideration the production facilities available for its manufacture.

One of the important design considerations involved was the selection of the type and size of the bearings and the design of the parts which house the bearings. Tapered roller bearings were selected for both the shafts but the mounting of these two shafts is entirely different.

The arrangement for the worm involves a fixed bearing at one end for carrying thrust load in either direction as well as radial load. At the other end the bearing was arranged for carrying a radial load only and was not restrained end-wise in the

A pair of giant worm gear speed reducers built by De Laval Steam Turbine Co. for the Mesta Machine Co. Units have a reduction ratio of $26\frac{2}{3}$ to 1. Each will be driven by a 200 hp, 410 rpm motor coupled directly to input shaft.

housing bore so that differential expansion of the worm could be accommodated.

The thrust bearing consists of a double Timken bearing with a cup spacer which is ground accurately to provide the proper clearance in the bearing assembly. The bearing cups are clamped firmly together by an end cover making this bearing non-adjustable. The radial bearing also consists of two tapered roller bearings. A cone spacer is used and the clamping of the cones or inner races against spacer by a locknut insures the proper adjustment of the bearing.

The output shaft bearings are identical tapered roller bearings which are adjusted against each other by shimming of the end covers which bear against the cup portion of the bearings. These shims are also utilized in adjusting the gear for proper contact with the worm.

It is interesting to note that in selecting the size of bearings required, the weight of the gear assembly was sufficient to become a factor in estimating bearing loads.

The use of welded steel construction for the gear casing obviated the need for patterns and insured a casing design of maximum stiffness and great shock resistance.

Close attention was given to the providing of a large oil reservoir below the worm to prevent undue heat generation by churning of the lubricant during continuous operation. Both external and internal ribbing were used to insure alignment of bearing bores under the most severe conditions. The internal ribbing was designed with particular care to avoid popping off oil in the main reservoir.

The worm and its bearings are lubricated by partial submergence in the oil bath. The gear also dips partly into the oil bath to provide lubrication between the worm threads and gear teeth and also to carry oil up to the top of the reducer where a special device directs oil into the shaft bearings. This device consists of a hinged scraper mechanism which by close proximity with the face of the gear directs oil into the reservoirs above the shaft bearings. In this way, continuous lubrication of these bearings is effected.

DIESEL-ELECTRIC UNIT

▲ General Electric Co. has added a new 35-ton twin-axle diesel-electric locomotive to its line of industrial switchers.

The new locomotive will fill in the G-E line between the smaller 25 ton and the larger 45 ton locomotive. G-E now has a complete line of seven industrial switchers ranging in weight from 25 to 95 tons and in power from 150 hp to 660 hp.

The new 35 tonner is 9½ ft wide compared with the 8 ft width of the 25 ton, the extra 1½ ft width making it possible for the operator to see around larger railroad cars. It is built 1½ ft lower than the 45 ton facilitating operation through low doorways in plant buildings.

The new locomotive is equipped with recessed Pullman type steps providing easier access to the deck and affording greater safety to the brakemen.

It has one diesel engine nominally rated 275 hp at 2100 rpm. It is directly connected to a General Electric Type GT-558 d-c, shunt-wound generator which is equipped with a winding to permit it to be used for starting the engine by storage-battery power.

Starting tractive effort of the locomotive is 21,000 lb at 30 per cent adhesion. On the level it will pull an average of 66 per cent more weight.

There is one auxiliary generator, mounted on the engine, to furnish auxiliary power at a constant potential over the full operating range of engine speed. A 16-cell, lead-acid type storage battery for starting the engine and for supplying auxiliary power when the engine is shut down, is charged from the auxiliary generator.

The locomotive has two G-E d-c traction motors each of which drives through double-reduction spur gearing. It is equipped with single-station, single-unit control with the operator's station placed on the right-hand side of the cab. Grouped at this station are the throttle lever, reversing lever, brake valve, sander valve, bell and whistle controls, window-wiper controls, gage panel, and switches for controlling lights.

The locomotive speed is controlled by the throttle lever, which regulates the diesel-engine output and is also interlocked with the electrical control. Maximum speed is 20 mph.

Air-brake equipment is straight air,

Dump it in their Lap!

THESE NAGLE PUMP SALES ENGINEERS ARE QUALIFIED TO HELP SOLVE YOUR PUMP PROBLEMS!

FREDERICK PUMP & ENGINEERING CO.
5743 Duarte St., Los Angeles 58, Calif.
COOPER ENGINEERING CO.
1639 Russ Bldg., San Francisco, Calif.
THE MINE & SMELTER SUPPLY CO.
1652-1698 Blake St., Denver 2, Colo.
W. D. TAULMAN & ASSOCIATES
452 Spring St., N.W. Atlanta, Ga.
THOMAS PUMP CO., INC.
37 West Van Buren St., Chicago 5, Ill.
ROUSSEL PUMP & ELECTRIC CO.
P. O. Box 9206, New Orleans, La.
HAYES PUMP & MACHINERY CO.
100 Vine Street, Somerville 43, Mass.
WM. A. DaLEE, INC.
9190 Roselawn Ave., Detroit, Mich.
C. T. DeHAAS COMPANY
Kaufman Building, Marquette, Michigan
F. H. BATHKE
490 N. Snelling Ave., St. Paul 4, Minn.
ENGINEERING & EQUIPMENT CO.
406 Market St., St. Louis, Mo.
JOHN REINER & CO.
36-50 38th St., Long Island City, New York
AMERICAN BRAKE SHOE COMPANY
Export Division, 230 Park Ave., New York 17, N. Y.
SIEWERT EQUIPMENT CO.
20 Eastland Ave., Rochester 18, New York
JORDAN ENGINEERING COMPANY
Roselawn Center Building, Cincinnati 37, Ohio

GEORGE P. SCHUMACKER CO.
1120 Chester Ave., Cleveland 14, Ohio
C. S. CARTER
920 World Bldg., Tulsa 3, Okla.
BYRON DUNKLEY
Commercial Trust Bldg., Philadelphia 2, Penna.
PITTSBURGH GAGE & SUPPLY CO.
P. O. Box 1168, Pittsburgh 30, Pa.
RAMSAY PUMP & SUPPLY COMPANY
1701 Keenan Building, Pittsburgh 22, Pa.
THE MINE & SMELTER SUPPLY CO.
410 San Francisco Ave., El Paso, Texas
MODERN ENGINEERING SALES
7401 Avenue N—Box 9234, Houston 11, Texas
THE MINE & SMELTER SUPPLY CO.
121 W. Second South St., Salt Lake City, Utah
FRANK HOWELL CO.
P. O. Box 36, Richmond 1, Va.
GENERAL MACHINERY COMPANY
P. O. Station B, Spokane, Washington
CROSS PUMP & EQUIPMENT COMPANY
Box 889, Charleston, West Virginia
MINERT PUMP & ENGINEERING CO.
4521 W. Center St., Milwaukee 10, Wis.

NAGLE PUMPS

NAGLE PUMPS, INC.
1263 CENTER AVENUE, CHICAGO HEIGHTS, ILLINOIS

PUMPS FOR ABRASIVE AND CORROSIVE APPLICATIONS

A new 35-ton diesel-electric locomotive has been added to the General Electric line of industrial switchers. The new 35-tonner, which is shown here at work at the Cambria Slag Co. in Johnstown, Pa., fills in the G-E line between the smaller 25 tonner and the larger 45 tonner.

with one self-lapping engineer's valve. Two brake cylinders are mounted on the underframe and operate fully-equalized brake rigging which applies one shoe to each wheel. A hand brake of the ratchet and drop-lever type is provided for holding the locomotive at a standstill.

Automatic air for trainline braking and brakeman's steps to meet Interstate Commerce Commission specifications can be furnished. Although standard weight is 35 tons, the locomotive can be ballasted to 40 tons.

ANNEALING FURNACE

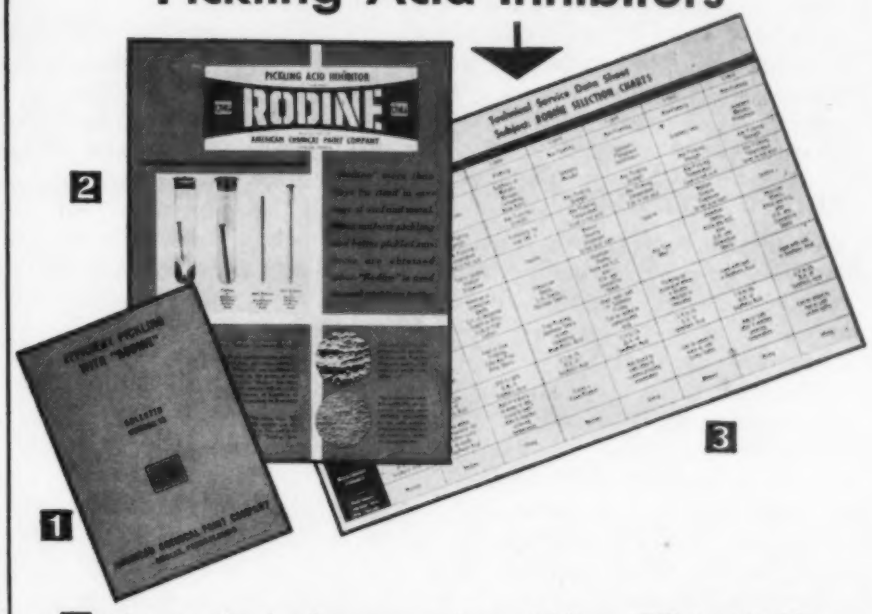
▲ In the not too distant future a stainless steel plate heat treating furnace will be installed by the Drever Co. in the Lukens Steel Co. plant at Coatesville, Pa. This will be the biggest heat treating furnace ever installed and will handle plates up to 130 in. wide × 480 in. long and 3/16 in. to 2 in. thick. The overall length of the line is approximately 365 ft being made up of a 50 ft-0 in. charge table, 202 ft-0 in. long roller hearth furnace, 10 ft-0 in. transfer table, 42 ft-0 in. long 1000 ton quench press and a 50 ft-0 in. discharge table arranged to swing 90 degrees for crane pickup of the plates. Temperature range will be 950 to 1950 F.

Heat treating cycles will be variable from 10 minutes to 12 hours to accommodate the wide variety of stainless and other steel analyses for which the equipment is intended. Rated capacity is 13,250 tons/month for stainless steel annealing. All conveyor rolls, furnace doors and discharge table swing mechanism will be motor operated and controlled by one man

New Data Available on . . .

RODINE®

Pickling Acid Inhibitors



1 The standard reference work on pickling, "Efficient Pickling With RODINE" — Bulletin Number 13 — is now available in a new, revised edition.

2 This new 4-page general descriptive folder presents essential information on "Rodine" pickling acid inhibitors.

3 The recently revised "RODINE SELECTION CHART" gives characteristics of and uses for typical "Rodines" used with sulfuric and muriatic acids. Technical Service Data Sheet No. 13-1-1-4.

Use coupon below for free copies of the literature described above.

AMERICAN CHEMICAL PAINT COMPANY

***General Offices:* Ambler, Penna.**

Niles, Calif. Detroit, Mich. Windsor, Ont.

CHEMICALS ACP PROCESSES

CLIP AND MAIL TODAY!

American Chemical Paint Co.
Ambler, Pennsylvania

Gentlemen:

Please send me FREE:

- ☐ "Efficient Pickling With RODINE" — Bulletin No. 13.
- ☐ 4-page general descriptive folder.
- ☐ "RODINE SELECTION CHART"

Name .....

Company Name .....

Address .....

City ..... State .....

from, control house located adjacent to the quench press.

The furnace proper will have a door opening of 12 ft-2 in. wide × 2 ft-6 in. high and an effective length of 202 ft-0 in. The furnace conveyor will consist of 14 in. diam rolls on 16 in. centers of patented pre-stressed refractory construction to minimize marking of the work. The furnace will be direct fired with combination natural gas or oil luminous flame burners. Temperature control will be propositioning and divided into 10 zones of 20 ft-0 in. each.

AIR CONDITIONER

▲ A large western Pennsylvania steel plant has recently air conditioned two pulpits and five crane cabs with notable improvement in productivity and employee relations.

Previous to the installation of this air conditioning equipment, pulpit personnel and crane cab operators worked in temperatures which often exceeded 140 F. Now these Lintern "Aire-Rectifiers" cool and clean the air in these hot spot areas of the plant.

As shown in the illustration, crane operators lift ingots from the soaking pit and deliver to the blooming mill every few minutes. Temperature of the hot ingots leaving the pits is 2400 F. Although the operator in his cab is but a stone's throw from this excessive heat, his cab, because of the air conditioning unit, is maintained at a comfortable 80 F.

Despite the 2400 F temperature of the ingot being lifted from the soaking pit below, the crane operator, thanks to his air-conditioned cab, works in a comfortable 80 F. Condenser units, located on the bridge, connect refrigerant lines with the cab cooling unit, maintaining a cool temperature and moderate humidity.

Likewise, the pulpit personnel must necessarily work directly over the receiving table where the red hot steel is delivered. Previously, they were constantly exposed to soaring temperatures. These men now work efficiently in a comfortably cooled room of glass and steel. The cooling units maintain a healthful, pleasant atmosphere for them.

The units are the "split-system" type. The cooling mechanisms are in the cabs and pulpits. For the cabs, the condenser units are located on the bridge and connected with refrigerant lines to the cab cooling units. In the case of the pulpits, the water cooled condenser is located in one of the columns of the pulpit and the cooling units are in the room where the men work.

It is easy to understand why personnel react favorably to rectified air — i.e., free of fumes and dust particles, circulated at a constant cool, healthful temperature and at moderate humidity. They work in comfort — and they accomplish more.

AUDIO TRANSMITTER

▲ A two-way voice communication system for industrial use, linking "base stations" with mobile units such as cranes, ore bridges, yard locomotives and boat unloaders, is a new development by Mine Safety Appliances Co.

The "MSA Telecrane" FM carrier communication system helps coordinate operations, speeding production, promoting safety, and reducing delays in materials handling, MSA engineers explain.

Clear, direct voice communication, audible above the noise level of plant operations, is achieved with this heavy-duty FM (frequency-modulated) "Telecrane" system, they add. It is free from transmission noise and interference.

No new or additional wiring connections are needed; it employs existing electrical circuits for transmitting carrier waves. A coupling capacitor joins the carrier frequency to any a-c or d-c power line. For isolated locations, circuits which operate on storage batteries are available.

The compactly designed transmitter-receiver unit is tray-mounted to facilitate servicing. The extension microphone, used in cranes and mobile equipment, is adjustable to any desired position, and a heavy-duty

Foreman in an eastern steel plant employs this new communication system to direct crane operator (left background) handling ingots at the soaking pits. The transmitter is wall-mounted to foreman's left, speaker at right, at this base station; in the crane the equipment box and transformer are conveniently located in the cab and the speaker is ceiling-mounted and easily adjustable to desired height. Clear two-way voice communication eliminates hand signals, expensive or dangerous errors, and reduces delays.

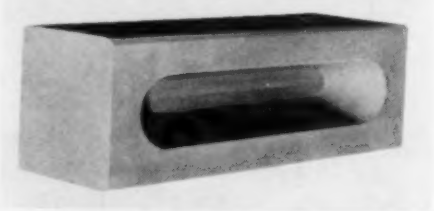
foot switch keys the transmitter or closes the speaker circuit, leaving the operator's hands free.

At the "base station" or permanently located units the operator need only depress a lever to talk, release it to listen. Each speaker has its own volume control so that it may be adjusted in relation to surrounding conditions. The loudspeaker has impedance-matching transformer which can be used with one to three speakers. An audio amplifier may be used if more than three speakers are desired off the same base equipment.

The compactly designed equipment box houses the transmitter-receiver unit, filter unit, terminal block and power circuit resistors.

GRAPHITE INGOT MOLD

▲ National Carbon Co., a Division of Union Carbide and Carbon Corp., has revamped and standardized its line of graphite pig ingot molds in order to permit quick deliveries, di-



rect from stock in most cases, or by quick machining in emergencies.

"National" graphite molds are in use as over-metal molds and in casting many special shapes of magnesium, steel, copper, brass and various other metals and alloys quickly and eco-

BUY USG® BRUSHES

Try USG Brushes. They will solve those tough application problems for you. • Complete manufacturing facilities, plus continuous research and engineering make USG Brushes and Contacts the best you can use on all rotating electrical equipment. • USG BRUSHES can do a *better* job for you . . . Let us arrange a performance test to prove it.

Write today for 40-page catalog giving complete information on standard USG grades.

90-B

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

nomically. They offer the following advantages: low initial and operating costs; smooth, clean, uniform-sized ingots or other shapes with no chemical contamination; no stickers because metals do not wet graphite; easy to use, light in weight and portable; will not crack, chip, spall, firecheck or warp; immunity to most severe heat shock; permit rapid pouring cycle and quick stripping merely by upsetting; no mold wash coating necessary; no pre-heating required; easy to machine or fit into mounting devices; easy to modify if necessary with ordinary wood working tools; and long, trouble-free life.

STRAIGHTENING UNIT

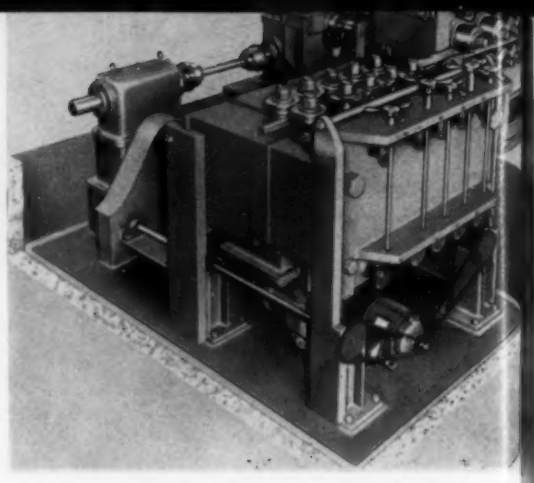
▲ Sutton Engineering Co. has announced the availability of a new high-speed two-plane straightening machine for steel and non-ferrous flats and shapes such as squares, hexagons, angles and other similar sections.

Known as the "Sutton 2½L," the new machine is built for accurate straightening at high production speeds from 100 to 1000 fpm. A typical installation is a unit equipped with a 60/75 hp, 500 to 1500 rpm adjustable speed d-c motor with a straightening speed of 166 to 500 fpm.

Two installations have been made thus far. The first installation was made in a cold drawing plant of a large steel manufacturer for high production precision straightening of cold drawn squares and hexagons. The second installation was ordered on the performance record of the first. A third machine is now under construction.

Designed for high speed, rugged durability and ease of operation, the new straightener has extremely large roll shafts on very close centers. This development promotes ease of straightening small sections, removing short hooks and permits use of anti-friction roller bearings throughout. Adjusting screws are overhung for greater stability when straightening larger sections.

The new machine will straighten squares from $\frac{5}{16}$ in. to $1\frac{3}{4}$ in., hexagons from $\frac{5}{16}$ in. to 2 in. and flats up to 3 in. × $\frac{5}{8}$ in. For speed of alignment, both vertical and horizontal straightening units are adjustable by means of push button control of motor driven screws. Perfect alignment of the pass line can be accomplished in seconds. As all rolls are overhung and accessible to the operator, roll change is simple and rapid. All roll adjustments are made manually by handwheels which are locked in position when machine is set up. Spring-loaded pinch rolls at the entry end of each unit assure positive feeding and enable placing the machine in a semi-automatic production line.



Variations of the design for either horizontal or vertical single plane use and for special size requirements or

FREE on request . . . bulletin on complete line of Anker-Holth products.

Your Anker-Holth cylinder matches your job

Sure, these power cylinders are unusual. The big one has an 18-inch bore and 19-inch stroke, and handles 2000 p.s.i. hydraulic pressure! The little one has a 1-inch bore and is for air power. But both are all in a day's experience of the nearby Anker-Holth engineer who is available to help you solve problems in power motion. To be sure you get the *right* air or hydraulic cylinder for *your* specific job, *specify* Anker-Holth and ask for our engineering help. Call or write Anker-Holth Division of The Wellman Engineering Company, Dept. E-3, 2723 Conner St., Port Huron, Michigan.

Anker-Holth
ENGINEERED CYLINDER POWER
WELLMAN

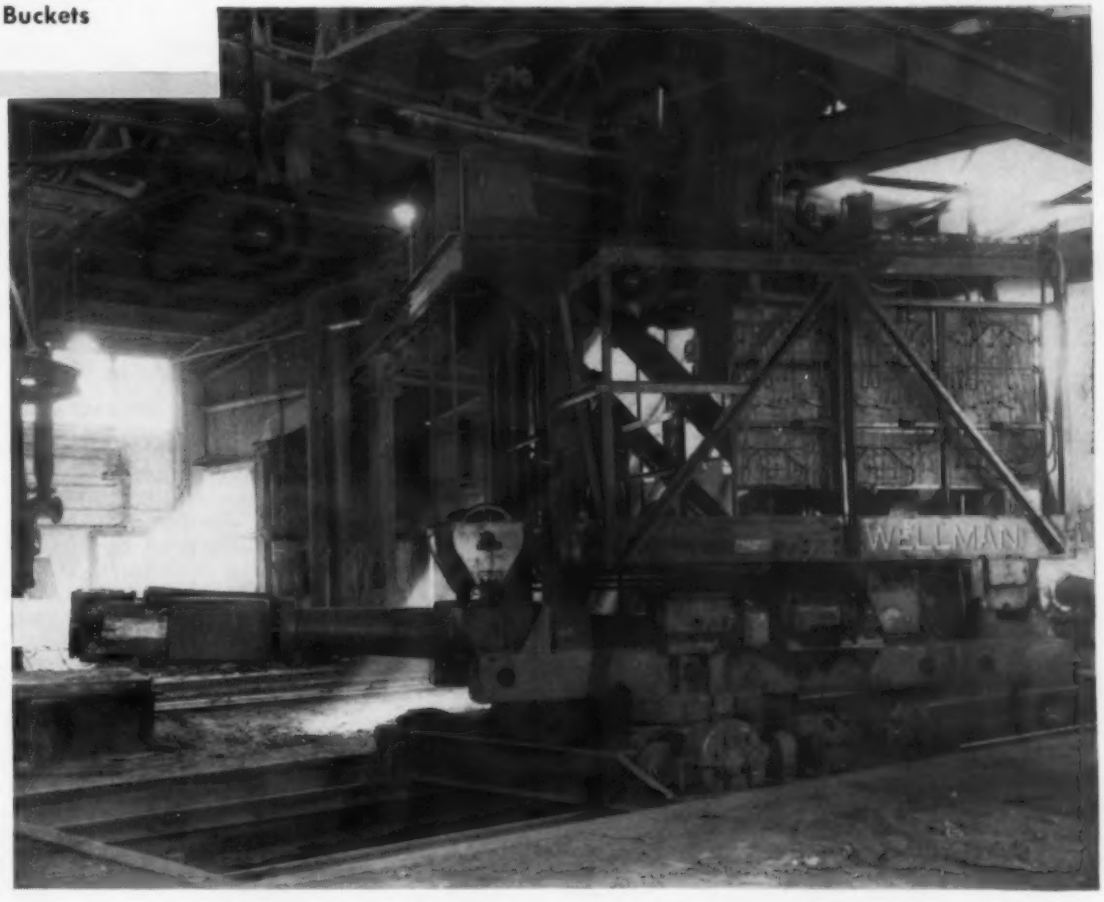
Division of
THE WELLMAN ENGINEERING COMPANY

Wellman will build it

Special Cranes
Forging Manipulators
Charging Machines
Ore Unloaders
Car Dumpers
Gas Flue Systems
Gas Reversing Valves
Coke Pushers
Mine Hoists
Skip Hoists
Ore and Coal Bridges
Clamshell Buckets

Wellman forging manipulators

handle big ingots speedily, efficiently



Wellman Forging Manipulator with white-hot ingot ready for forging.

● Wellman Forging Manipulators hold hot steel ingots on anvil dies, turn them and keep them level for efficient forging . . . despite hammering shocks. You can count on *all* Wellman equipment for speedy, economical service. It is backed by more than a half century of leadership in designing manufacturing and construction of heavy materials handling facilities.

THE WELLMAN ENGINEERING COMPANY

7000 CENTRAL AVENUE • CLEVELAND 4, OHIO

. . . and production is up

with AIRE-RECTIFIERS

Here is a hot job in a large steel mill. Every time the crane taps a pit, it picks up a mass of molten metal at 2400 F. for delivery to the receiving table. Blasts of hot air soar upward.

Yet — the crane operator works efficiently in a comfortable temperature due to a Lintern Aire-Rectifier. The cab unit is located conveniently in the cab and the condenser unit on the foot-walk.

Five cranes and two pulpits are air conditioned in this plant — and more are planned. These Aire-Rectifiers mean greater production, improved employee relations and less turnover of skilled labor.

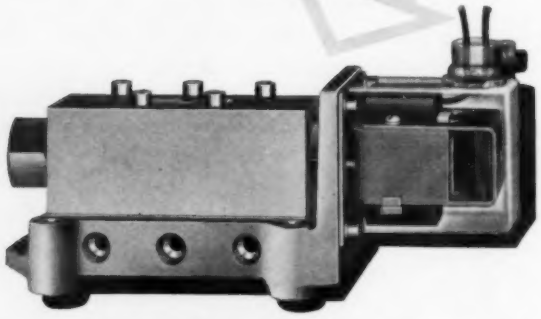
Hot weather is on the way — write or wire us today about your needs.

THE LINTERN CORPORATION

Route 20, East Painesville, Ohio

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves

FEATURE THIS MONTH

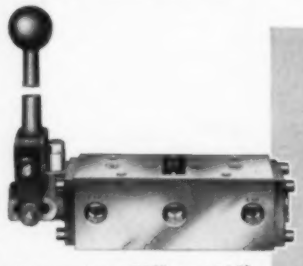


1/8" and 1/4" Single Solenoid Valves

They'll give you up to 300 cycles a minute
For air to 125 psi—vacuum—
or low pressure hydraulic service

● These valves combine the utmost simplicity in design with rugged construction. They will give you millions of cycles of highly satisfactory, efficient, trouble-free service. Small solenoid, with short stroke operates the valve plunger, eliminating levers, links and pins. Low amperage requirement eliminates intermediate relays and simplifies electrical control circuits. Side or bottom pipe connections. Valve body and solenoid are both mounted on an aluminum base and can be removed independently without disturbing the piping. 2, 3, 4 and 5-way actions. *Write for full details today!*

also the following

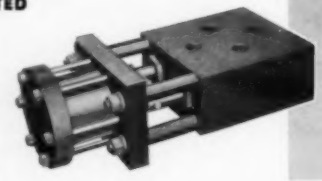


LEVER OPERATED SINGLE PLUNGER VALVES

Two position and three position valves, 3/8" to 1 1/2" sizes; 2-way, 3-way and 4-way actions. Widely used for controlling the operation of single and double acting cylinders or as pilots for operating other valves.

PILOT CYLINDER OPERATED HYDRAULIC VALVES

Two position valves, 1/2" to 4" sizes, for line pressures from 1000 to 5000 psi. Valve is placed close to the work and operated from a central control point with an easy to handle air valve avoiding operator fatigue.



For Fully Descriptive Data Sheets Write

C. B. HUNT & SON, Inc.

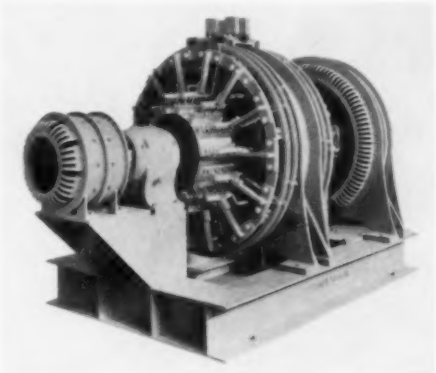
Hand, Foot, Lever, Cam, Pilot, Diaphragm and Solenoid Control Valves

1921 EAST PERSHING STREET • SALEM, OHIO

other particularized applications are available.

MOTOR-GENERATOR SET

▲ Chandeysson Electric Co., designers and manufacturers of motor-generators for over fifty years, have made a redesign of its line of low voltage motor-generator equipment. The new line features improved commutation, all-welded steel construction, increased accessibility and more open ventilation, which results in greater overload capacity and higher overall efficiency.



Generator and exciter brushes, coils and commutator are now fully accessible for inspection, cleaning or removal, without the necessity of removing any other components. Higher overall efficiency is said to be realized with the new design which allows unrestricted air circulation around and through the generator. The exciter brushes are mounted on the inboard side to prevent accidental damage and also to insure smoother operation, thereby increasing brush life. Over-size split sleeve bearings adjacent to the commutators assure smooth operation and permit overloading without heating. Brush life is considerably increased with the new design which features sparkless commutation even at the guaranteed overload capacity of the generators.

The prime move is a direct-connected low speed, heavy-duty, synchronous motor with either 80 per cent leading or unity power factor. Designed and built by Chandeysson, each motor is specifically designed to amply do the job required by the generator. High pull-out torque permits smooth and efficient operation even when the generator is overloaded. Extra windings on the rotor poles produce high-starting torque, permitting the use of across-the-line starting devices.

To assure unified responsibility and high quality product, the motor-generator set is completely manufactured at the Chandeysson plant. Thus the engineering integrity of design is maintained not only through specifications but also through tested engineered quality control under Chandeysson supervision.

Chandeysson generators are available in sizes from 300 to 20,000 amperes at specified voltages.

SEMI-SILICA BRICK

▲ New type semi-silicious brick used principally to overcome difficulties arising from structural spalling or deformation of furnace walls, roofs, arches, etc.

Typical installations: Larger forging furnaces, heating furnaces of all kinds, hot blast stoves, open hearth furnace checker arches, fantails, etc.

This unique brick, manufactured by Illinois Clay Products Co., offers the advantages of increased modulus of rupture, greater resistance to spalling, and precision dimensions.

ELECTRO-MAGNET

▲ This large diameter electro-magnet for handling scrap was built by Electric Controller & Mfg. Co.

EC&M started building lifting magnets under the first lifting magnet

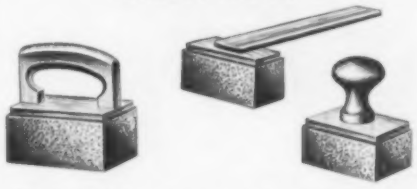
patent in the world and exhibited the first successful scrap-handling magnet (circular type) at the St. Louis World Fair in 1904.

The new magnet (80 in. in diameter) is of all-welded construction. Because of its large diameter, it is especially useful on light-weight, or "wind-blown" scrap — the term commonly used to describe the grade of scrap available the past few years.

MARTINDALE

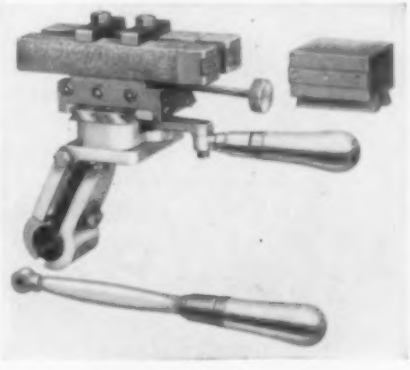
COMMUTATOR MAINTENANCE EQUIPMENT

COMMSTONES



Manually held Commstones made in a variety of sizes and with various handles. Eight grades available for proper resurfacing of commutators and slip-rings.

TYPE "C" COMMSTONE HOLDER



Holds Commstones rigid and true for concentric resurfacing of commutators and slip-rings while running at normal speeds in their own bearings. Grinds commutators up to 4¾" wide. Used with two Commstones in stone holder or one Commstone in 2" box.

MICA-MILLER UNDERCUTTER

A powerful, light-weight, low cost, easy to use Undercutter, operating from 1/5 h.p. Universal motor. Available with small, medium or heavy-duty head (interchangeable). Alsoavailable with air motor or flexible shaft drive.

Write for new Catalog No. 29 of Electrical, Industrial and Maintenance Equipment.

MARTINDALE ELECTRIC CO.

1331 Hird Ave. Cleveland 7, Ohio

TIN PLATE GAGE

▲ Applied Research Laboratories has announced execution of a contract with Jones & Laughlin Steel Corp., for the production of a revolutionary tin plate thickness gage.

This instrument, engineered by Jones & Laughlin, uses the x-ray principle for measurement of thickness of tin on steel to accuracies of one-millionth of an inch, making such measurements automatically while the tin plate is traveling at high speeds as a continuous sheet on the Jones & Laughlin tin plating production line.

The Jones & Laughlin contract with Applied Research Laboratories calls for delivery of three measuring units and other accessories for installation in a Jones & Laughlin tin plate mill early in 1954. The instrument so developed will have application to many plating and gaging problems in the tin can, aluminum foil and other fields, and substantial orders from other industries are anticipated by ARL's management. While the design of the immediate equipment is Jones & Laughlin's, Applied Research Laboratories' research and engineering activities have been extensive in this field and it is in an excellent position to start production of the required equipment immediately.

Besides being active in developing x-ray gaging equipment, ARL will soon place on the market a new line of x-ray equipment suitable for providing continuous chemical analyses of a variety of products.

POLYPHASE MOTOR

▲ General Electric has announced that it will build polyphase motors with the new frame standards recently approved by the National Electrical Manufacturers Association.

The company estimates that its new 182 and 184 frame polyphase motor designs will be completed and samples available by late fall of this year. Larger frames will be made available at later dates, and quantity production of the new motors will follow shortly after the availability of samples.

According to G-E engineers, the new motor frame assignments will allow better utilization of space within motor frames and result in greater horsepower per frame size, by taking advantage of better materials and advances in the art of motor designing. Performance characteristics such as torques, starting currents, and temperature rise will remain unchanged, they said.

CONVEYOR BELT

▲ Three miles of conveyor belt "highway," a major feature of Colorado Fuel and Iron Corp.'s improved ore-preparation plant in Pueblo, Colo., now makes this plant one of the most efficient in America.

Thirty electrically-driven rubber belts — three feet wide — travel underground, through tunnels, and up steel inclines to transport raw materials to and from freight cars, crushers, storage bins and piles. A flick of a switch reverses the flow of materials, by-passes certain operations, or fills freight cars.

Iron ore and limestone travel separately over the belt system. Limestone follows a fairly direct route through the crusher and on to the new loading system. Ore must pass through the crushers and over screens

ONE MAN HANDLES IT EASILY

FARNCO
ALL ALUMINUM
CONVEYOR

Built to reach inaccessible places, carries brick, sand, flu dust, wet concrete. Can be used in multiple units for long hauls.

POWERED BY AIR GAS or ELECTRIC

Built of **STRONGEST, TOUGHEST,** aluminum
Designed and manufactured by precision engineers who specialize in close tolerances. **SAVES MANPOWER SAVES $ $**

NATIONAL DISTRIBUTORS
FARNCO SALES CO.
PITTSBURGH 8, PA., P. O. Box 5796, Phone EMerson 1-7602

Get our illustrated literature, HOW it operates. →

"Mother's asleep now, son," Dad told him. "She'll be asleep a long, long time. It's kind of like going away. We'll have to learn to get along without her, Johnnie."

To a statistic named Johnnie

Who's Johnnie? Just one of the 175,000 children under eighteen here in the United States who have lost a mother to cancer.

Statistics are a little too big for a boy this small to understand. Even the hopeful ones about cancer—and there are more every year.

More and more today—cancer can be cured

Patients are being cured who could not have been saved—even five years ago. In 1952, some 70,000 with cancer were saved.

And this number could have been doubled, if treatment in all the cases had been begun in time.

Your contributions to the American Cancer Society helped make such hopeful statistics possible. And they can make the story even brighter tomorrow.

Not for Johnnie, to be sure.

But for all the other children—*they might be yours*—who still have their mothers and fathers. If only *one tenth* of the millions of people like you who have such good intentions would actually take the time to send us their contributions! *And would do it now—instead of turning the page . . .*

AMERICAN CANCER SOCIETY

Gentlemen:

Please send me free literature about cancer.
Enclosed is my contribution of $_____
to the cancer crusade.

Name _____

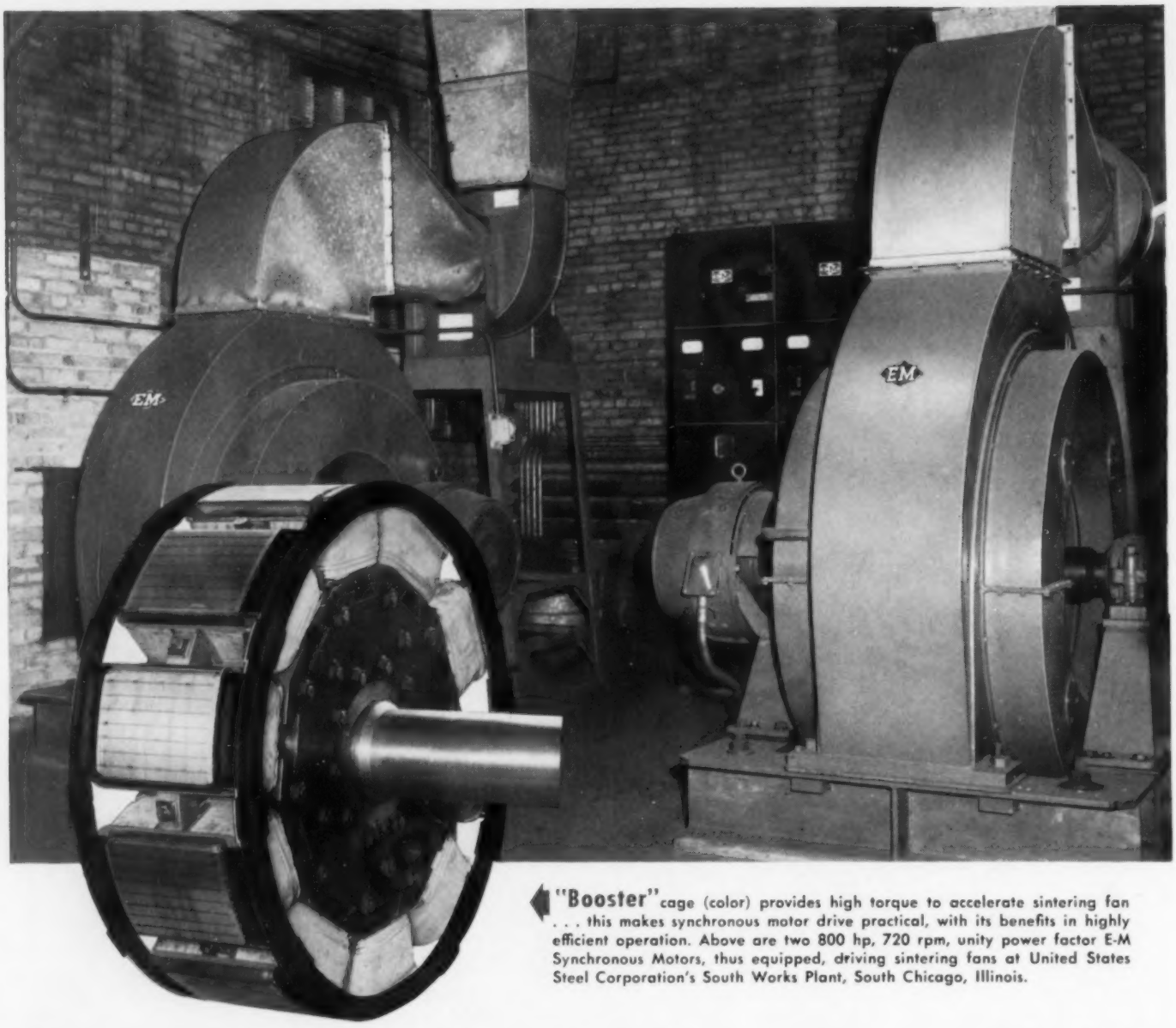
Address _____

City _____ State _____

Simply address the envelope:
"Cancer," c/o Postmaster, Name of Your Town

CANCER STRIKES ONE IN FIVE

Strike back—give to the American Cancer Society



"Booster" cage (color) provides high torque to accelerate sintering fan . . . this makes synchronous motor drive practical, with its benefits in highly efficient operation. Above are two 800 hp, 720 rpm, unity power factor E-M Synchronous Motors, thus equipped, driving sintering fans at United States Steel Corporation's South Works Plant, South Chicago, Illinois.

How to drive a sintering fan most profitably

● There are sound reasons why synchronous motors (such as the installation above) are the most economical sintering fan drives. Consider your power bill . . . the high efficiency of the synchronous motor produces maximum usable horsepower from a minimum of electric power. Your entire electrical system will benefit from power factor improvement through the unique ability of synchronous motors to correct lagging power factor. You save on power costs both ways. And motor maintenance costs are low too.

However, the fans have a large WK^2, and sintering begins with a cold bed. So, E-M engineers developed a special double-deck starting cage for these difficult starting and synchronizing requirements. Here's what it does:

Characteristics of this E-M extra-heavy-duty double-cage winding are such that uniformly high torque is provided for both starting and pull-in. This E-M winding not only accelerates the heavy fan, but also provides that powerful "boost" to 98½% of synchronous speed needed to pull it into step.

Further assurance of powerful synchronizing is offered by the E-M-invented Polarized Field Frequency Control which automatically applies field excitation at the instant when rotor angle will give maximum synchronizing power with no pole slippage. Current inrush is held at a minimum.

E-M's pioneering and long experience in synchronous motor applications have resulted in many profitable steel plant installations. Ask your nearest E-M sales engineer for his practical suggestions on your requirements.

ELECTRIC MACHINERY MFG. COMPANY
Minneapolis 13, Minnesota

1100-TPA-2146

E-M

Specialists in making motors do
EXACTLY WHAT YOU WANT THEM TO

where the fine particles are removed for sintering. The balance of the ore is conveyed direct to the blending piles. With this new layout it is now possible to crush both soft and hard ores to the optimum size for blast furnace use.

SYNCHRONOUS MOTOR

▲ The most powerful electric motor ever built, 83,000 hp, has been installed at the Arnold Engineering Development Center, Tullahoma, Tenn. It is the first major step in assembly of the 216,000-hp electric drive for the new transonic and supersonic wind tunnels for the U. S. Air Force.

The giant synchronous motor is one of two such units built by the Westinghouse Electric Corp. at East Pittsburgh, Pa. The second unit will be installed in the near future, along with two 25,000-hp Westinghouse induction motors.

Still under construction at the Westinghouse plant in Sunnyvale, Calif., are the five compressors these four motors will drive. The compressors, also the largest ever built, will have blades two feet wide and six feet long mounted on a spindle 18 feet in diameter. Each blade weighs almost two-thirds ton, and will rotate at a speed of 600 rpm.

When the motors and compressors are completely assembled, they will comprise the world's largest rotating machine.

Prior to the construction of the 83,000-hp motors, the world's largest motors were six 65,000-hp units built for Grand Coulee Dam in the state of Washington. Four of these motors, built by Westinghouse, are now pumping water from the Columbia River to irrigate the semi-arid region of south-central Washington.

FILM TEMPLETS

▲ Repro-Templets Inc. of Oakmont, Pa., announces a new line of "Repro-Templets" on film of over 10,000 standard machine-tools and metal-working plant equipment items, for plant layout uses.

These templets are printed on .0075 in. acetate film and represent the overall dimensions of the machine or piece of equipment. They show, in dotted lines, the floor contact base; and are clearly identified with typeset lettering.

The templets may be selected from a stock of over 10,000 items — both machine-tool and plant equipment — and are available for immediate shipment at an average cost of 8¢ to 12¢ each.

These repro-templets on film have been checked for accuracy by the manufacturers of the machines and equipment — and when used in conjunction with film grid sheets, provide the most accurate, time-saving and money-saving 2-dimensional plant layout system yet devised.

BULB CHANGER

▲ No longer is it necessary to climb ladders, etc., risking accidents to change light bulbs, says the J. B. Sebrell Corp. With their new, amazing, easy-to-use light bulb changers, you can remain safely on the ground or floor and change bulbs, even broken ones, that are 42 ft and more above the floor.

By using lightweight aluminum sectional poles with the proper bulb changer attachment on the end, you can make various lengths of poles to change bulbs at any height. By inserting the unexpanded end of one pole into the expanded end of another, you can build any desired length of pole. The changer attachment can be easily and quickly attached to the end.

Attachments are available for various size bulbs from 15-watt to 1500-watt and for various shapes. An angle adjustment can be added to allow bulbs at any angle to be changed.

For broken light bulbs, simply attach the Sebrell broken light bulb remover which fits both standard and mogul lamp bases.

As an added protection, an insulated 5-ft pole section is available for use with other regular sections of aluminum poles. This protects the user from possible electrical current which might be transmitted through the aluminum poles.

PRODUCTION UNIT

▲ Ferguson Equipment Co.'s Unitline is a production line unit which is completely automatic and which can be used for the clean heat treatment, carburizing, dry cyaniding, small parts or large parts which do not have to be handled on trays. No operator

(*Please turn to page 199*)

for **MAINTENANCE MEN**
INSTRUCTORS
and TRAINEES
in Motor Maintenance

THE methods and procedures described were developed by recognized, practicing maintenance authorities. They have been proven by conclusive evidence over many years in hundreds of operations. A concise guide, this 39-page handbook tells the practical operating man everything he needs to know about:

- **Commutator and slip ring troubles and how to correct them.**
- **Brush maintenance and operating procedure.**
- **General maintenance procedure.**

Dozens of illustrations show the operations described. Condensed data on IDEAL commutator and slip ring products is included.
Even if you do not have a regular maintenance training program, your people responsible for motor and generator maintenance need, and will do a better job, with the help of this handbook.

NOTE: **This offer is limited to those in plant and other industrial operations. We reserve right to limit quantities furnished. Offer may be withdrawn at any time.**

IDEAL INDUSTRIES, Inc. IDEAL
1045 Park Avenue, Sycamore, Illinois

Please send _____ copies of your free handbook on commutator and slip ring maintenance.

Name_____

Title_____

Company_____

Address_____

City_____ Zone_____ State_____

YOU NEED THIS New 32 PAGE DATA BOOK

Anyone concerned with the construction and maintenance of steel plant furnaces, including all kinds of forge furnaces, needs this new 32-page Data Book "Steel Plant Furnace Construction with Ramtite (Plastic Refractory)." It contains details of application and service results for specific constructions such as burner walls, suspended roofs, etc. There is also considerable technical information not previously published that will be of definite interest and of considerable value to ceramic and fuel engineers, as well as mason and operating personnel.

RAMTITE

THE RAMTITE CO.
Division of The S. Obermayer Co.
18 3 S. Rockwell Street, Chicago 8, Illinois

Please send a copy of your new 32-page data book.

Company Name_____

Attn. Mr._____ Title_____

Address_____

City_____ Zone_____ State_____

Superior

BLAST FURNACE COPPER CASTINGS

100th ANNIVERSARY 1853-1953

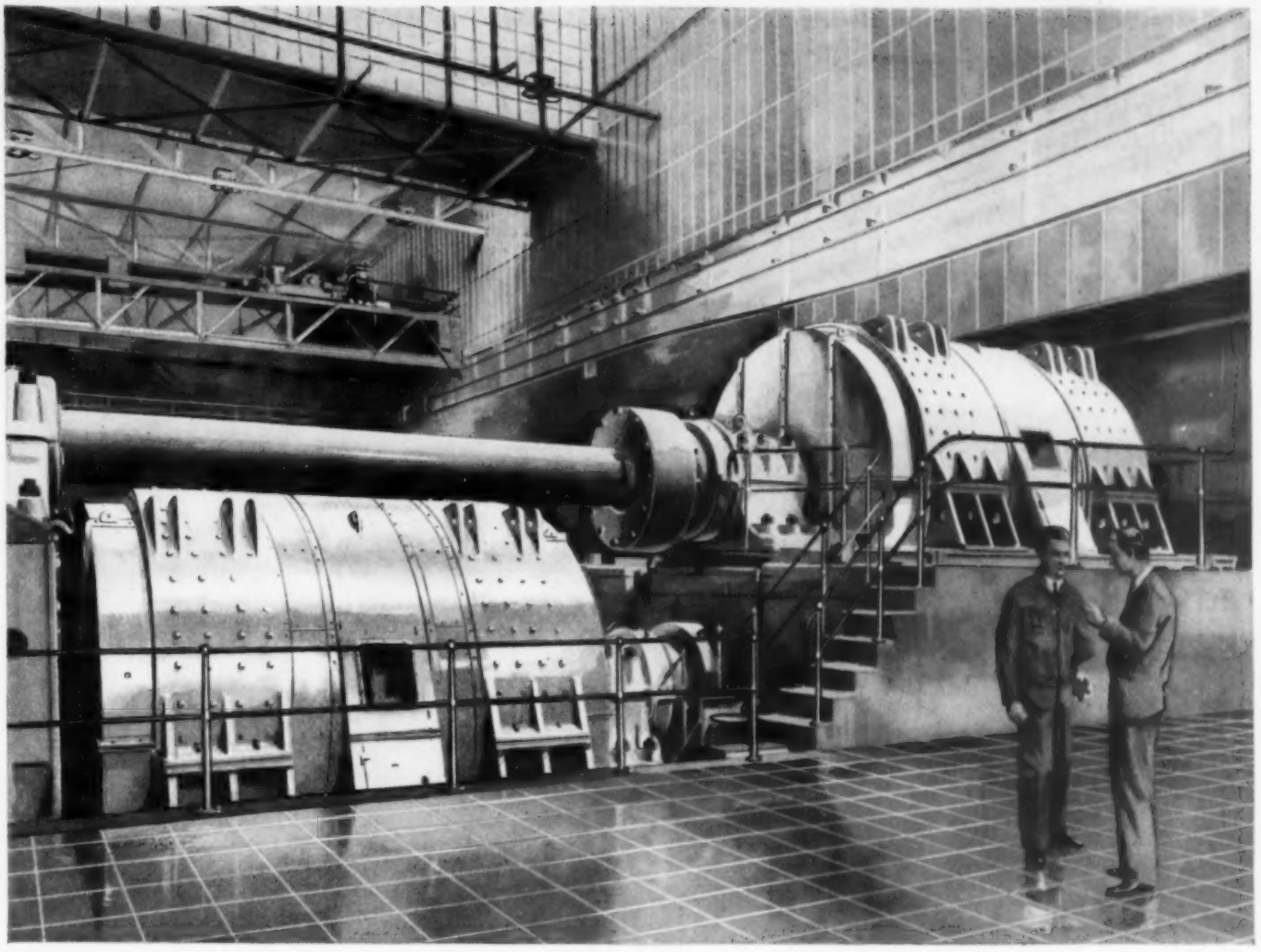
SMEETH-HARWOOD COMPANY
8524 Vincennes Ave., Chicago 20, Illinois

when you CHANGE over to SPRAYING SYSTEMS descaling NOZZLES

If you want to materially reduce down time on rolling mills due to clogged nozzles, try Spraying Systems descaling nozzles. Large orifice diameter permits passage of practically all particles that ordinarily clog other types of nozzles. Spraying Systems nozzles produce an effective uniform flat spray, free of streaks, with an impinging force equal to over 96% of the maximum potential. Typical user is the Homestead District Works of U. S. Steel illustrated above. Nozzles are made of hardened stainless steel in a wide range of capacities and spray angles. Your inquiry is invited . . . write for Data Sheet 3997.

SPRAYING SYSTEMS CO.
3262 RANDOLPH STREET • BELLWOOD, ILLINOIS

Also write for Data Sheet 4516 . . . Pneumatic Atomizing Nozzles for direct spray gear lubrication.



Modern rolling mill practice . . .

The twin drive, with each roll driven separately, thereby eliminating the pinion stand, was pioneered by 'ENGLISH ELECTRIC' as early as 1922. Shown here are the main motors of a double armature twin reversing drive developing 27,600 peak horsepower, for a 45 inch slabbing mill. The rapid acceleration and deceleration required is obtained by the 'ENGLISH ELECTRIC' standard reversing mill Control System, employing the 'ENGLISH ELECTRIC' Magnavolt rapid response control exciter.

The Company has supplied many drives for both hot and cold rolling mills, including over fifty main drives for hot reversing mills, as well as many other hot mill drives for continuous and semi-continuous strip, sheet, wire rod and merchant sections. Also, the long experience of 'ENGLISH ELECTRIC' in this field provides a wealth of information on all electrical problems . . . power and substations, cabling and ventilating and complete layouts.

'ENGLISH ELECTRIC'

rolling mill drives

Offices in Halifax, Montreal, Ottawa, Toronto, Winnipeg, Calgary, Edmonton, Vancouver
English Electric Company of Canada Limited. Head Office and Factory: St. Catharines, Ontario

POOLE

A COPY OF CATALOG GIVING FULL DESCRIPTION AND ENGINEERING DATA SENT UPON REQUEST.

FLEXIBLE COUPLINGS

POOLE FOUNDRY & MACHINE COMPANY

WOODBERRY, BALTIMORE, MD.

In electrical installations *where QUALITY counts* use CONDULETS*

Quality does count in practically every electrical conduit installation that you make. When you use CONDULETS you know that you are putting in electrical equipment of the highest quality, because CONDULETS have been doubly tested . . . in the factory and in the field.

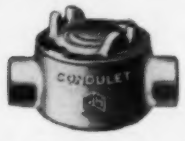
Crouse-Hinds quality control assures a long-lasting product and field records prove it by the test that only time can give. Thousands of CONDULET installations are still in tip-top condition after twenty, thirty, or even more than forty years of dependable service.

The illustration at the right shows four of Crouse-Hinds' basic quality features that are common to all CONDULETS. The fifth, Wedge Nut Fasteners, is an exclusive Crouse-Hinds feature that has made Obround CONDULETS preferred by electricians everywhere.

Type EVA Explosion-Proof Lighting Fixture

Type ARE Arktite Receptacle Equipment

Type FS Condulet With Pilot Lamp Receptacle, Switch and Plug Receptacle



Type GUAC Explosion-Proof Junction Condulet

1. **Taper tapping.** Condulet threads are taper tapped to match tapered conduit threading. Makes a rigid joint that will not loosen. This assures permanent ground continuity . . . important for safety.
2. **Integral bushing.** A smooth rounded surface protects wire insulation.
3. **Material.** Feraloy . . . a special alloy that is strong and tough, resists corrosion, and gives sharp, full threads
4. **Finish.** A triple treatment provides long-lasting protection . . . exceeds Federal and U. L. specifications.
5. **Wedge Nut cover fastener.** Clear cover opening . . . no projections. No loose parts . . . Wedge Nuts and screws self-retained. No screw holes to align.

More than 15000 items are listed in the Condulet Catalog including a complete explosion-proof and dust-tight line for use in hazardous locations.

On your next job, use CONDULETS . . . they're made right to last longer.

**CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.*

Type VC Vaportight Industrial Lighting Fixture

Type FLB Explosion-Proof Circuit Breaker Condulet

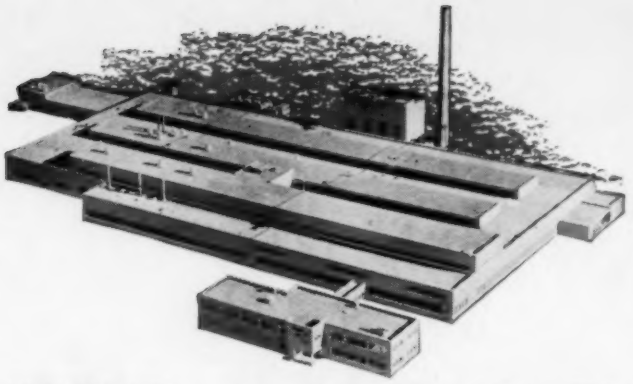
Type EPC Explosion-Proof Motor Starter and Circuit Breaker Condulet

A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

OFFICES: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston Indianapolis — Kansas City — Los Angles — Milwaukee — Minneapolis — New Orleans — New York — Philadelphia Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Tulsa — Washington.
RESIDENT REPRESENTATIVES: Albany — Atlanta — Baltimore — Charlotte — Corpus Christi — Richmond, Va. — Shreveport Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS



N-B-M Meadville . . . where the welcome mat is out. We're proud of this plant—its equipment and the skilled people who work in it. Proud enough, in fact, to offer a standing invitation to Blast Furnace Superintendents or other steel mill officials to visit us. When can *you* make an inspection trip?

These CASTINGS have "RUN THE GAUNTLET"

Here's where you'll find copper castings that have been subjected to rigid tests for soundness and quality.

Another Reason why N-B-M Meadville is a name to remember when you specify copper castings. What does your eye tell you when you see this picture? Chances are, "a big selection of copper castings". And, it's true that this big selection is typical of the wide range of copper castings that N-B-M Meadville is equipped to produce.

But, there's something more important that no ordinary photograph can show . . . because each of these castings has its own "success story". Each has been subjected to the most painstaking system of production and quality control that you'll find in any foundry . . . anywhere. That's why we say that castings reaching our shipping room have "run the gauntlet" . . . *we know they're right.*

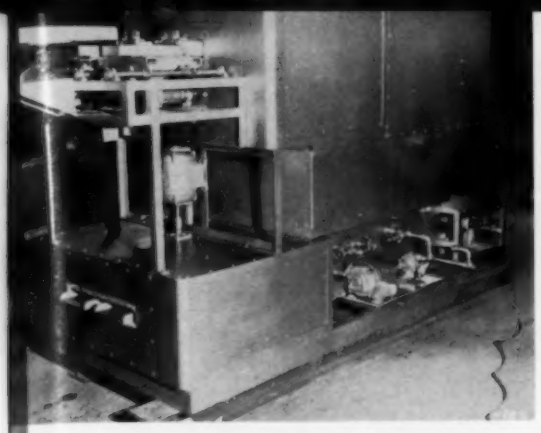
From the molding floor to the shipping room, N-B-M Meadville accomplishes what should be, and is, the main objective of this modern, well-manned plant . . . ***what you specify . . . we ship.***

AMERICAN Brake Shoe COMPANY

NATIONAL BEARING DIVISION

4936 Manchester Avenue • St. Louis 10, Mo.

PLANTS IN: ST. LOUIS, MO • MEADVILLE, PA. • NILES, OHIO • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.



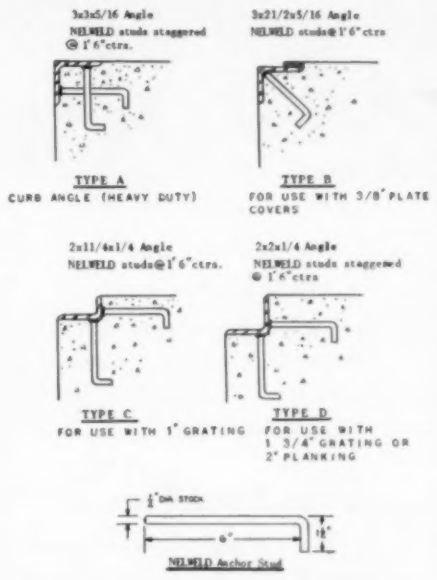
(*Continued from page 193*)

is required for its operation since it is a package unit which can be placed into a production line and which will take parts from a conveyor and deliver them to a discharge conveyor. The space requirements have been reduced to an absolute minimum and in most cases the line requires one-half the space that the present heat treat lines require now offered by competitive companies. Absolutely no transfer of parts being processed is required and the parts are not handled at all if the proper conveying systems are furnished to and from the unit. The Unitline can be made for individual running of 1 to 4 different parts simultaneously at individual cycles. The unit can be fired with either gas or electricity and the range of temperatures will be 1750 in the hardening furnace and 1350 in the draw furnace. The unit is complete with hardening furnace of the atmosphere type, oil or water quench tank, washing machine, and either open or atmosphere draw furnace. The production capacity of the units will be from 75 to 500 lb per hour in at least 6 different sizes. In the smaller units the conveyor through both furnaces will be of the shuffle hearth mechanism and in the larger units the hardening furnace will be of the shuffle hearth mechanism and the draw furnace shall be of the mesh belt type of conveyor. The design of this unit was developed to fit the needs of certain customers who desire the unit which could be put into a production line and charge the work completely automatic, handling those kind of parts which cannot be handled manually profitably.

CONCRETE STUDS

▲ Development of special concrete anchor studs designed to simplify fabrication and improve the quality of steel curb angles, trench frames, column guards, joists and other structural members to be anchored in concrete or masonry has been announced by the Nelson Stud Welding Division of Gregory Industries, Inc., Lorain, Ohio.

High quality cold-drawn steel with a tensile strength of 75,000-85,000 psi is used in the new fluxed anchor studs which are welded in the angle or on the faces of steel members without causing any distortion. Accessories for use with portable stud welding equipment insure accurate alignment so that work can be done at the job site where necessary. Simple table-mounted production units designed for use in fabricating shops will install anchor studs at the rate of four to five per minute.


3x3x5/16 Angle
NELWELD studs staggered @ 1' 6" ctrs.
3x21/2x5/16 Angle
NELWELD studs @ 1' 6" ctrs
TYPE A
CURB ANGLE (HEAVY DUTY)
TYPE B
FOR USE WITH 3/8" PLATE COVERS
2x11/4x1/4 Angle
NELWELD studs @ 1' 6" ctrs.
2x2x1/4 Angle
NELWELD studs staggered @ 1' 6" ctrs
TYPE C
FOR USE WITH 1" GRATING
TYPE D
FOR USE WITH 1 3/4" GRATING OR 2" PLANKING
NELWELD Anchor Stud

Nelson stud welding equipment, including battery and special motor-operated welding machines, is available on a rental or purchase basis through Nelson factory branch warehouses and dealers in all major industrial centers.

CRANE CAB COOLER

▲ Air conditioning of crane cabs in steel mills and foundries is fast becoming a recognized necessity because of the extreme ambient conditions of high temperature, fumes, etc., encountered.

Actually, a crane operator working in a high ambient temperature is subjected to artificially induced fever. When body temperature rises progressively to 102 F, a man will continue to work fairly efficiently, but when this limit is exceeded, efficiency declines quickly and the workmen are liable to heat exhaustion, cramps, fatigue and headache. The only way of reducing such temperatures to normal comfort level is by mechanical refrigeration; normal comfort conditions being 80 to 85 F inside the cab.

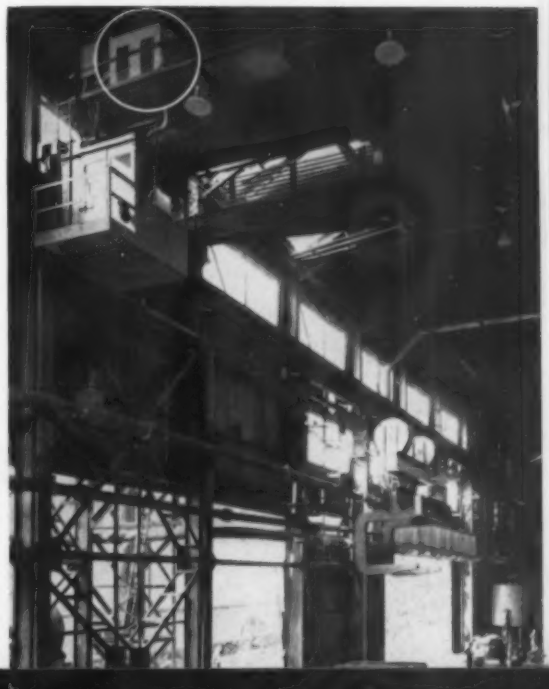
Crane cab air conditioning units which combine adequate, ample refrigeration with an effective method for reduction or elimination of dust, dirt, fumes and gases, provide a highly satisfactory economical method for increasing human efficiency and working conditions.

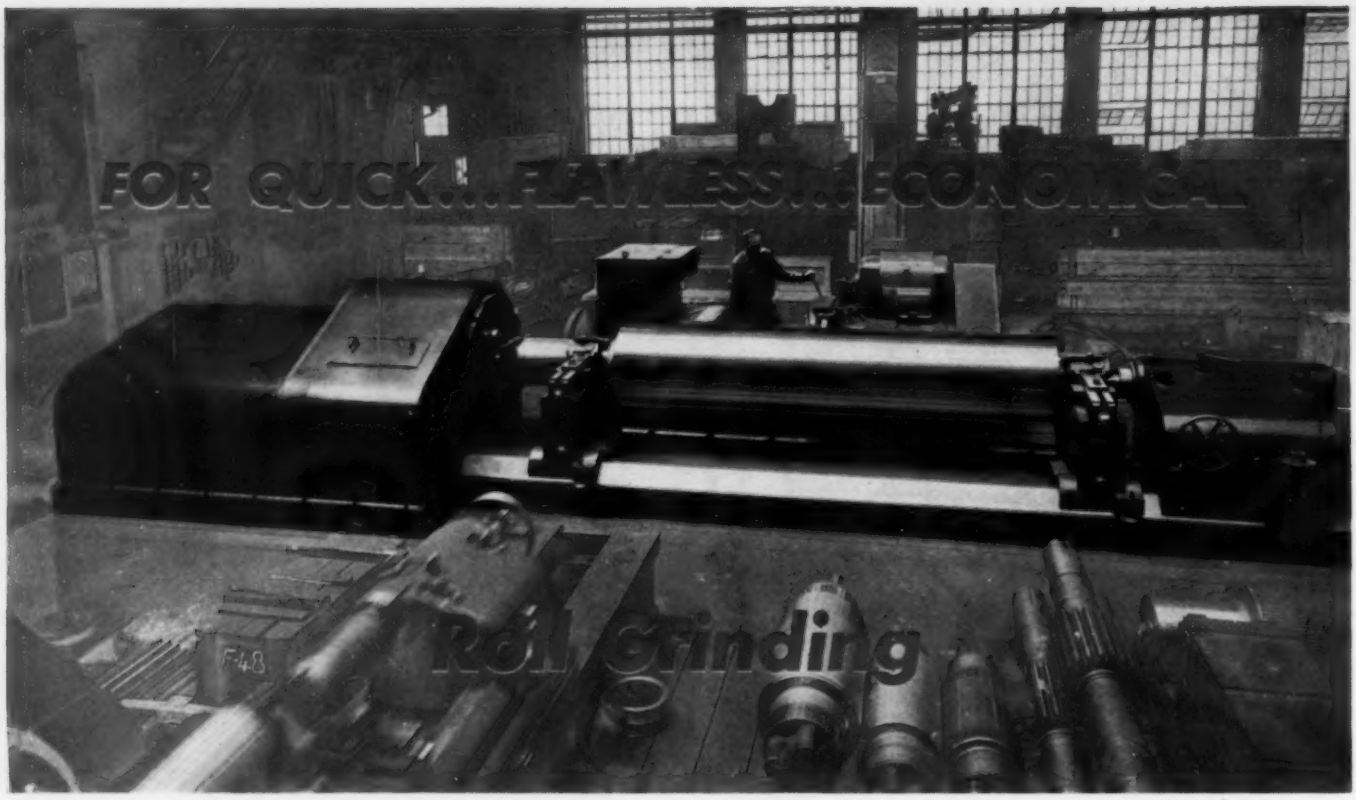
An example of how this can be accomplished is the installation of a Dravo Corp. "Model C-5SP" split-unit cab cooler on a crane at the Monessen, Pa., plant of the Pittsburgh Steel Co. The equipment is especially designed for high temperature conditions such as are encountered in hot slab mill operation. It provides summer cooling, winter heating and continuous ventilation including the removal of dust, gas, fumes and odors from the cab. Designed with thermostatic control for automatic operation, this split-unit maintains 80 to 85 F in summer when ambient temperature is 150 F.

The evaporator section is located inside the cab and the condenser section on the crane bridge above. The two units are connected by refrigerant piping. Condenser and motor are air cooled, consequently no water is required.

(*Please turn to page 202*)

Pittsburgh Steel Co. hot slab mill crane equipped with a Dravo Corp. split-unit cab cooler (circle), which provides summer cooling, winter heating and continuous ventilation including the removal of dirt, dust, gas, fumes and odors from the cab. Operating automatically, it maintains cab temperature between 80 and 85 F in summer.





FARREL ROLLING MILL MACHINERY

- Rolls
- Rolling Mills
- Rod Mill Tables and Manipulating Equipment
- Universal Mill Spindles
- Rod Coilers
- Gears
- Mill Pinions
- Pinion Stands
- Gear Drives of Any Capacity
- Flexible Couplings
- Roll Grinding Machines
- Roll Calipers

...QUICK

Reports from users of Farrel Heavy Duty Roll Grinders indicate that with the latest type machine they are able to cut roll grinding time substantially. This holds true for both heavy roughing and fine finishing.

...FLAWLESS

Rolls are obtained with a perfect surface free from marks of any kind. Straight, concave or convex contours are ground to exact symmetry and accuracy.

...ECONOMICAL

Faster grinding means increased productive capacity of the machine and less labor per roll ground.

In addition, the rolls have longer life because the exceptionally smooth and vibration-free action in roll, wheel and traverse drives means less metal has to be removed to clean up a roll in roughing and finishing operations. This is a vital factor in reducing the frequency of roll replacement and, consequently, the cost of new rolls.

Send for further information about Farrel roll grinders.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Los Angeles, Houston

Farrel-Birmingham®

FB-839

THE ENGINEERING MART

WHERE TO BUY
EQUIPMENT FOR SALE
POSITIONS VACANT
POSITIONS WANTED

AN *IRON and STEEL ENGINEER* SERVICE TO THE STEEL MILL OPERATORS

WHERE TO BUY

BIRMINGHAM DISTRICT

DIXIE ENGINEERING COMPANY
"Manufacturer's Agents"
P. O. Box 750 — 812-813 Protective Life Building
BIRMINGHAM 3, ALABAMA
Sabel E. Baum — Telephone 4-0417

CHICAGO DISTRICT

PAUL W. WENDT & SONS
Manhattan Building
CHICAGO 5, ILLINOIS
District Representatives for
A. W. CADMAN MFG. CO.
HUNTER SAW & MACHINE CO.
GRAFO COLLOIDS CORP.

EHRET AND KINSEY
Board of Trade Bldg., 141 West Jackson Blvd.
Chicago 4, Illinois — Wabash 2-0449
Representing
THE CLEVELAND WORM AND GEAR CO.
"Cleveland" Worm Gearing and Worm Gear Speed Reducers
THE FARVAL CORPORATION
"Farval" Centralized Lube Systems
LUBRICATION PRODUCTS COMPANY
"Stapax" Journal Box Lubricators
AMERICAN FLEXIBLE COUPLING COMPANY
"Amerigear" Flexible Couplings
WALDES KOHINOOR, INCORPORATED
"Truarc" Retaining Rings

PHILADELPHIA DISTRICT

TOWLE & Son Co.
18 West Chelten Ave. — GE 8-1930
PHILADELPHIA 44
Representing:
THE TOOL STEEL GEAR AND PINION CO.
Cincinnati 16, Ohio

PITTSBURGH DISTRICT

ROLLING MILLS and EQUIPMENT
FRANK B. FOSTER, INC.
2220 OLIVER BUILDING PITTSBURGH 22, PA
Cable Address "FOSTER" Pittsburgh

METALLIC RECUPERATORS
(Air Preheaters)
For application to soaking pits, heating, and other types of metallurgical furnaces.
HAZEN ENGINEERING CO.
Park Building — PITTSBURGH, PA.
COurt 1-7032

PATTERSON-EMERSON-COMSTOCK, INC.
ENGINEERS AND CONSTRUCTORS
Specializing in Steel Mill Construction
313 E. Carson Street
Pittsburgh 19, Pa.
Phone: EVergiade 1-9800

Auburn & Associates, Inc.
Engineers
ELECTRICAL LAYOUTS FOR STEEL MILLS
923 Penn Ave., Pgh. 22, Pa.
Telephone COurt 1-5014

W. G. KERR CO., INC.
520 Oliver Building — PITTSBURGH, PA.
Phone: ATlantic 1-4254
Representing:
FOOTE BROS.—Gears and SpeedReducers
REEVES—Variable Speed Drives
THOMAS—Flexible Couplings
WICHITA—Air Tube Disc Clutches & Brakes
TELSMITH—Telsmith Crushers
CULLEN-FRIESTEDT—Sheet Lifters—Welding Positioners—Track Cranes

CHEMSTEEL CONSTRUCTION COMPANY, INC.
204 Chemsteel Bldg., Walnut St., Pittsburgh 32, Pa.
Send data on Engineering & Construction facilities for
ACID-ALKALI-PROOF CONSTRUCTION
of pickling and other tanks; flooring.
(TEAR OUT & MAIL WITH LETTERHEAD)

PITTSBURGH (Continued)

RITTER ENGINEERING CO.
Engineers - Distributors - Contractors
1515 WEST LIBERTY AVE. — Phone:
PITTSBURGH 26, PA. — LOCUST 1-1303
Representing:
TRABON ENGINEERING CORP.
"Centralized Lubricating Systems"

OHIO LOCOMOTIVE CRANES
WELLMAN (Williams) Buckets
Clamshell — dragline — grab's
hook-on and special buckets
NORTHWEST crawler and truck-mounted cranes and shovels
LOCOMOTIVES — Diesel & Diesel Electric
New and Used Equipment
H. KLEINHANS CO.
Established 1911
560 ALCOA BUILDING
PITTSBURGH 19, PA. — Phone AT 1-4641

CONSULTING ENGINEERS

cFc co.
417 TERMINAL BUILDING
YOUNGSTOWN 3, OHIO
DESIGNERS OF
COMPLETE STEEL PLANTS

LOYAL R. MILBURN
Consulting Electrical Engineer
Registered State of Michigan
1928 Guardian Building • Detroit 26, Michigan
Telephone: Woodward 3-8706 or
Whitmore Lake 5141

W. VANCE MIDDOUGH & ASSOCIATES
Consulting Electrical Engineers
Engineering • Design • Layout
Heavy Industrial Power & Light
204 Columbia Building .. Cleveland 15, Ohio
Prospect 1-2060

STEEL CITY ENGINEERING AND CONSTRUCTION COMPANY
Engineers & Builders of SPECIAL MACHINERY
Rehabilitation of Old Machinery & Furnaces of all Types.
Steel Mill Equipment & Construction.
Consulting Engineering Services,
Foundation Engineering & Construction.
Estimates & Appraisals of Plants & Equipment:
535 FIFTH AVE., PITTSBURGH 19, PA.
Phone EXpress 1-0780

THE ENGINEERING MART
(CONTINUED)

CONSULTING ENGINEERS

LOEDDING ENGINEERING CO., INC.
CONSULTING, DESIGN AND DETAIL
Industrial and Commercial Planning
Bridges, Structures Of All Types
Material Handling
Conveyors, Gantry, Overhead and Jib Cranes
Reninforced Concrete and Foundations
Industrial Piping and Ventilation
ECONOMY BANK BUILDING • AMBRIDGE, PENNA.

PRODUCTS

Engineered-Rebuilding
of Your Machine Tools
SIMMONS MACHINE TOOL CORP.
Albany 1, New York
Pittsburgh Representative:
3541 Laketon Road PEnhurst 1-3700

MODERN
MILL OPERATORS' PULPITS
DESIGNED BY
WALLACE F. SCHOTT
CONSTRUCTED BY
JAMES CAMPBELL SMITH, INC.
WILLOUGHBY OHIO

POSITIONS VACANT

ENGINEER
General all-purpose engineer with experience in Open Hearth and Plate Mills for eastern steel plant. Box 702, IRON AND STEEL ENGINEER. 1010 Empire Building, Pittsburgh 22, Pa.

POSITIONS WANTED

ELECTRICAL LINES WANTED!
Established manufacturers agent is desirous of representing an additional electrical equipment or supply firm in the Western Pennsylvania, West Virginia, and Eastern Ohio area. Box 701 IRON AND STEEL ENGINEER, 1010 Empire Building, Pittsburgh 22, Pa.

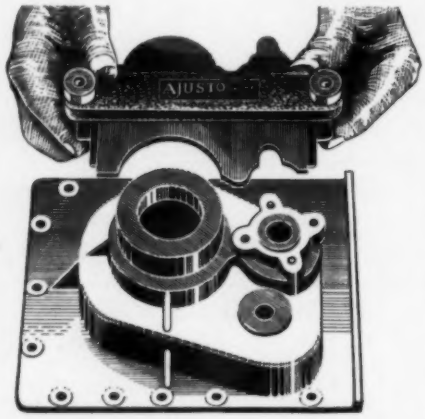
USE THE ENGINEERING MART

EQUIPMENT NEWS

(*Continued from page 199*)

TEMPLATE

▲ Both a male and female profile are obtained in a matter of seconds with the new "Ajusto" profile template. Hours of painstaking template-making are eliminated, yet accuracy is assured, for the template is composed of a number of hard brass strips, each one only .007 in. thick. This permits remarkably close adjustment to practically any profile, yet provides extremely close tolerances.



This recently-introduced template makes it possible to obtain profiles in seconds. It permits close adjustment while providing for close tolerances and has found widespread use in fabrication and process fields.

Although the template has only recently been introduced, engineering departments and maintenance departments in basic steel industries have found wide-spread use for it in most lines of fabrication and process.

The "Ajusto" is distributed by Toolcraft Manufacturing Co. for $19.50.

CONNECTOR

▲ New liquid-tight connectors have recently been placed in production by Appleton Electric Co. They are UL-approved for protection of electrical conductors on machinery where liquid-tight flexible conduit is used, and they are especially recommended where a liquid-tight flexible raceway is required.

The unique design of these connectors provides for an all-metal flaring ferrule which, under the compressing action of the tightening nut, is joined securely with the flexible conduit into a liquid-tight connection.

Designated as "ST" series, these connectors assure a positive means of excluding oil, water, acid fumes, chemicals, grease and dirt from the wiring system, and provide a positive ground between flexible conduit and connectors. The electrical resistance between the "ST" connectors and the liquid-tight flexible conduit is extremely low. Tests show voltage drop to be less than 10 millivolts.

The new connectors are furnished complete with all accessories — no other parts required. Available in straight, 45 and 90 degree connectors — conduit sizes ⅜ in., ½ in., ¾ in., 1 in. and 1¼ in.

Book Reviews . . .

▲ **"Textbook of Structural Shop Drafting,"** Volume 2, will be available for distribution in September 1953. This book has been prepared by the American Institute of Steel Construction. Volume 2 covers advanced work in structural steel detailing. It is suitable for use either as a text in the second year of a course in structural shop drafting, or as a companion reference work to Volume 1 for use in courses in Structural Design as well as in design office practice. The book will be similar in style, appearance, and binding to that of the earlier Volume 1, and will contain approximately 200 pages. It is for sale at $3.00 per copy, shipping charges prepaid in U.S.A. and Canada. Orders are now being accepted at the Institute offices, 101 Park Avenue, New York 17, N. Y. Shipments will be made in September or as soon thereafter as possible.

GUARD YOUR FAMILY
LEARN TO RECOGNIZE
CANCER'S DANGER SIGNALS

- Any sore that does not heal
- A lump or thickening in the breast or elsewhere
- Unusual bleeding or discharge
- Any change in a wart or mole
- Persistent indigestion or difficulty in swallowing
- Persistent hoarseness or cough
- Any change in normal bowel habits

Be on the alert for cancer's symptoms. They may not mean cancer — but they should always mean a visit to your doctor.

AMERICAN CANCER SOCIETY
GIVE TO THE CANCER CRUSADE

INDEX TO ADVERTISERS

JULY, 1953

A

Aetna-Standard Engineering Co. 1
Air Products, Inc. 165
Ajax Flexible Coupling Co. 2
Alliance Machine Co. 56
Allis-Chalmers Manufacturing Co. 4, 5
American Brake Shoe Co., American Manganese Steel Division 9
American Brake Shoe Co., National Bearings Division 198
American Chemical Paint Co. 134, 183
American Flexible Coupling Co. 36
American Wheelabrator and Equipment Corp. 24
Anker-Holth Division, Wellman Engineering Co. 186
Armzen Co., Division of Armco Steel Co. 125
Askania Regulator Co. 48

B

Bailey Co., William M. 149
Bailey Meter Co. 14
Blaw-Knox Co., Machinery Division 54
Blaw-Knox Co., Rolls Division 152, 173
Bliss Co., E. W. 12, 13
Bonnot Co. 46
Browning and Co., Inc., Victor R. 22
Bussmann Manufacturing Co. 114, 115

C

Cities Service Oil Co. 49
Clark Controller Co. 45
Cleveland Crane and Engineering Co., The 50
Cleveland Quarries Co., The 141
Continental Foundry and Machine Co. 7
Crane Co. 47
Crouse-Hinds Co. 197
Cutler-Hammer, Inc. Cover 2

D

Documentation and Licenses (Paris, France) Cover 1
Dowell, Inc. 126
Drever Co. 43

E

Electric Controller and Manufacturing Co., The 11, 40, 161
Electric Machinery Manufacturing Co. 192
English Electric Manufacturing Co. of Canada, Ltd. 195

F

Falk Corp., The 15
Farnco Sales Co. 190
Farrel-Birmingham Co., Inc. 200
Farrell-Cheek Steel Co. 147
Farval Corp., The Cover 3
Flinn and Dreffein Engineering Co. Cover 1
Foote Brothers Gear and Machine Corp. 174
Foxboro Co., The 160
Fuller Co. 120
Furnace Engineers, Inc. 119

G

Garlock Packing Co., The 44
General Electric Co. 30, 31, Cover 4
General Motors Corp., Hyatt Bearings Division 113
Guyan Machinery Co. 140

H

Halden Machine Co., The Cover 1
Heyl and Patterson, Inc. 6
Houghton and Co., E. F. 144
Hunt and Son, Inc., C. B. 188
Hyde Park Foundry and Machine Co. 145

I

Ideal Industries, Inc. 193
Industrial Gear Manufacturing Co. 151

J

Johns-Manville Corp. 157
Jones Foundry and Machine Co., W. A. 171
Joy Manufacturing Co. 42

K

Kaiser Aluminum and Chemical Corp. 29
Koppers Co., Inc. 122, 123, 138

L

Leeds and Northrup Co. 8
Linde Air Products Co., Division of Union Carbide and Carbon Corp. 41
Link-Belt Co. 155
Lintern Corp., The 188

M

Mackintosh-Hemphill Co. 158, 159
Manning, Maxwell and Moore, Inc., Shaw-Box Division 3
Martindale Electric Co., The 189
McKiernan-Terry Corp. 10
Mesta Machine Co. 204
Miles and Partner, John (London, Ltd.) Cover 1
Minneapolis-Honeywell Regulator Co. 34, 35
Morgan Construction Co. 27
Morgan Engineering Co. 129

N

Nagle Pumps, Inc. 182
National Carbon Co., Division of Union Carbide and Carbon Corp. 33, 162

O

Okonite Co., The 148

P

Pennsylvania Transformer Co. 23
Plasteel Products Corp. 18
Pollock Co., The William B. 136
Poole Foundry and Machine Co. 196
Post-Glover Electric Co. 28

R

Ramtite Co., The 194
Ross Carrier Co., The 139
Rowan Controller Co. 175
Rust Furnace Co. 111
Rust-Oleum Corp. 38

S

Salem-Brosius, Inc. 39
Selas Corp. of America 37
SKF Industries, Inc. 32
Smeeth-Harwood Co. 194
Sprayings Systems Co. 194
Square D Co. 142
Surface Combustion Corp. 16, 17

T

Timken Roller Bearing Co., The 132
Tool Steel Gear and Pinion Co. 177
Torrington Co., The, Bantam Bearings Division 179
Trabon Engineering Corp. 180
Truflo Fan Co. 143

U

Union Carbide and Carbon Corp., Linde Air Products Co. 41
Union Carbide and Carbon Corp., National Carbon Co. 33, 162
United Engineering and Foundry Co. 21
United States Graphite Co., The 185

V

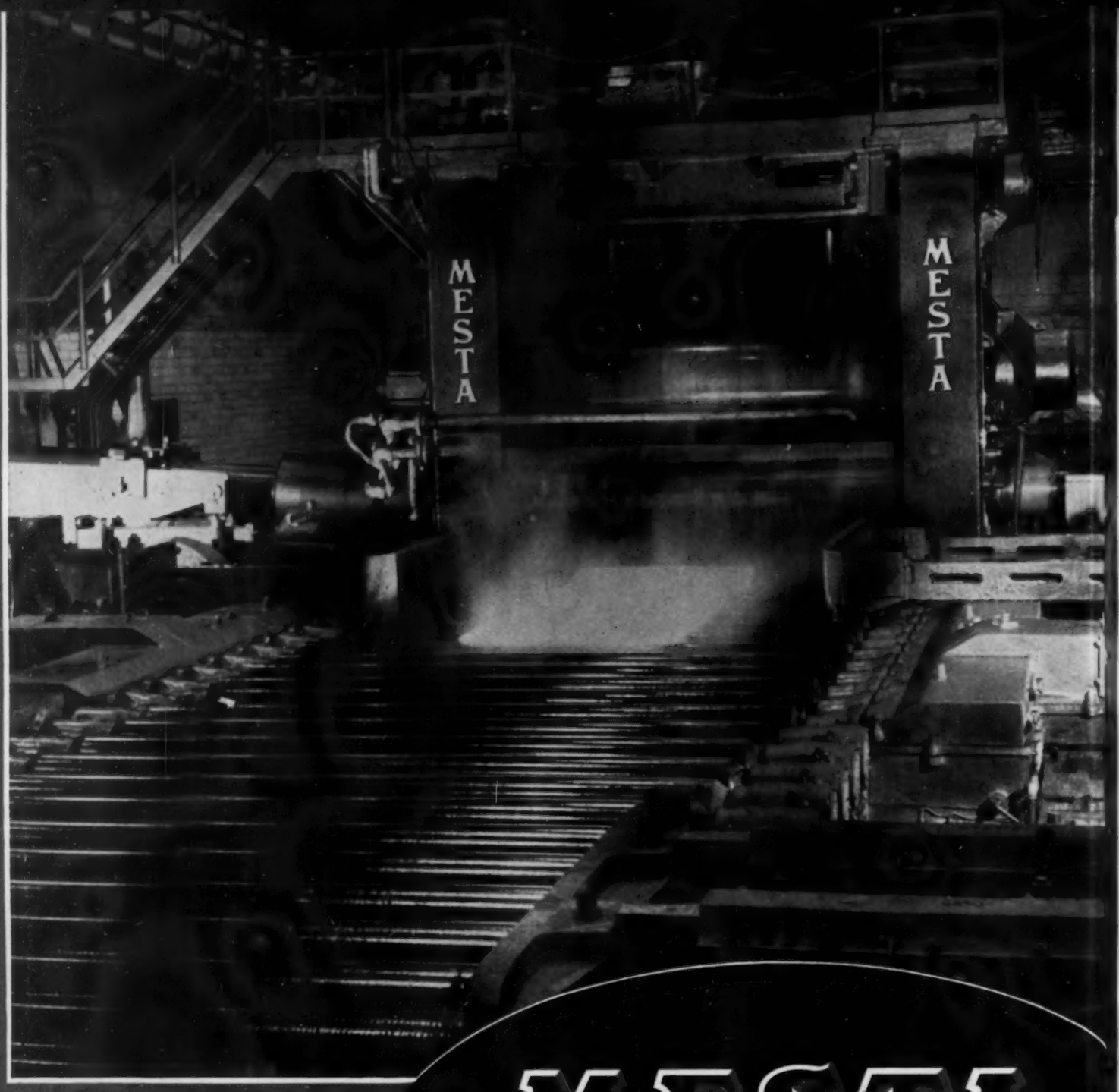
Vaughn Machinery Co., The 156

W

Wagner Electric Corp. 124
Walker Process Equipment Co. 20
Waterbury Farrel Foundry and Machine Co 135
Wean Engineering Co., Inc., The Cover 1
Wean Engineering Co. of Canada, Ltd. Cover 1
Wean Equipment Corp. Cover 1
Wellman Engineering Co., The 187
Westinghouse Electric Corp. 52, 53, 130, 131
Wilson Engineering Co., Inc., Lee 19

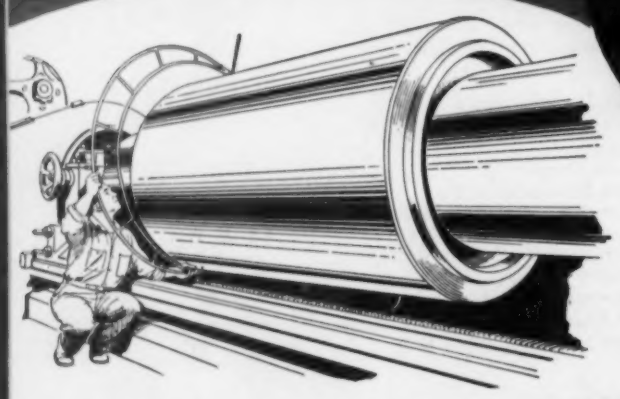
Y

Youngstown Alloy Casting Corp. 168
Youngstown Foundry and Machine Co. 121



MESTA 160" FOUR-HIGH REVERSING PLATE MILL

MESTA
PLATE MILLS



FINISH GRINDING A LARGE MESTA BACKING-UP ROLL IN A MESTA HEAVY DUTY ROLL GRINDER

Designers and Builders of Complete Steel Plants

MESTA MACHINE COMPANY

PITTSBURGH, PENNSYLVANIA

FARVAL SPRAY VALVES save 95% of lubricant and do 100% better job

FARVAL—*Studies in Centralized Lubrication*
No. 149

COUNT the number of open gears on your machines. Multiply the amount of grease required for these gears by 95% and you'll have the savings in lubricant alone which Farval Spray Valves can bring.

Even more important than lubricant saving, the Farval Spray Valve spreads and maintains a uniform thin film of oil or grease evenly over all bearing areas —eliminates friction, increases efficiency, lowers power costs, reduces wear.

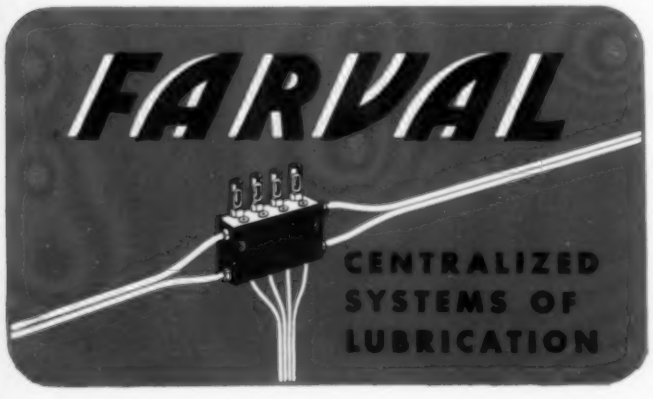
The Farval Spray Valve System is designed especially for lubricating open gearing and slide surfaces. Using an adaptation of the familiar Dualine Valve, this system sprays oil or grease from nozzles in just the right amount and at any desired interval.

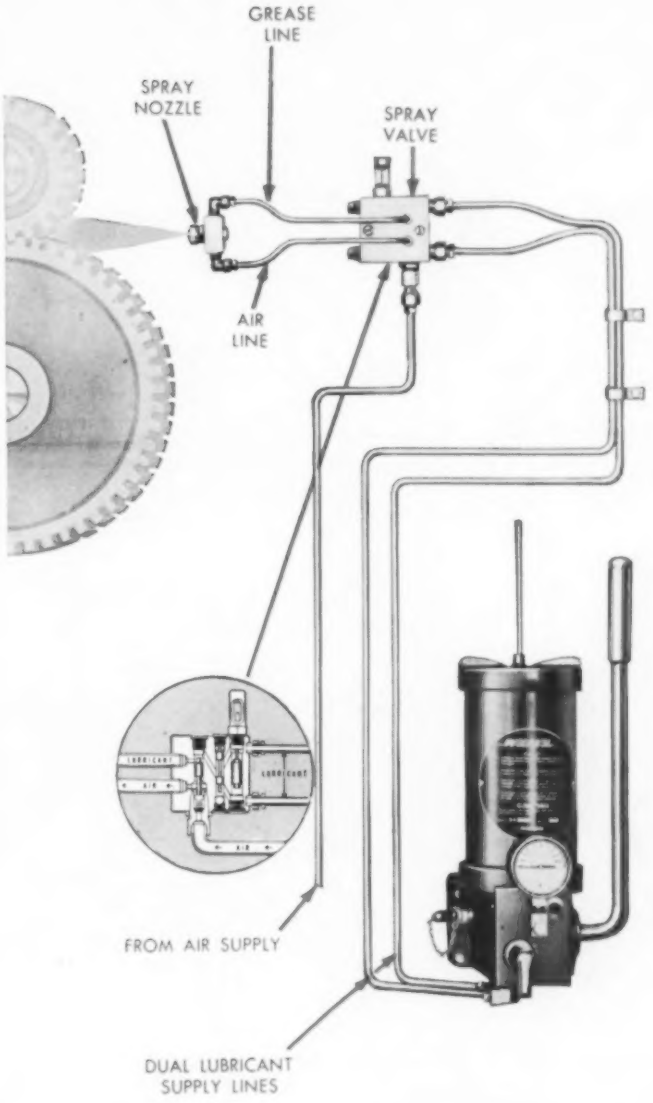
No more wasteful hand paddling of lubricant on gear teeth with the hope it will spread itself uniformly. No more blobs of grease splotching up the floor—creating safety hazards. The Farval Spray Valve System has proved it can maintain a clean, even film of lubriçant at all times while machines are in operation. No waste. No mess. No trouble.

Farval Spray Valves can be inserted in a regular Farval Dualine System wherever compressed air is available. Or a complete Farval Spray Valve System may be installed, consisting only of Spray Valves served by a manual or automatic pumping unit. As indicated in the sketch at right, compressed air is directed through the Spray Valve, which meters air to the delivery nozzle at the same time that the lubricant is metered. Positive cut-off after delivery eliminates bleeding.

Why not insure that your open gearing and slide surfaces get the lubrication they need? Write for a copy of Farval Spray Valve Bulletin No. 60 today. The Farval Corporation, 3278 East 80th Street, Cleveland 4, Ohio.

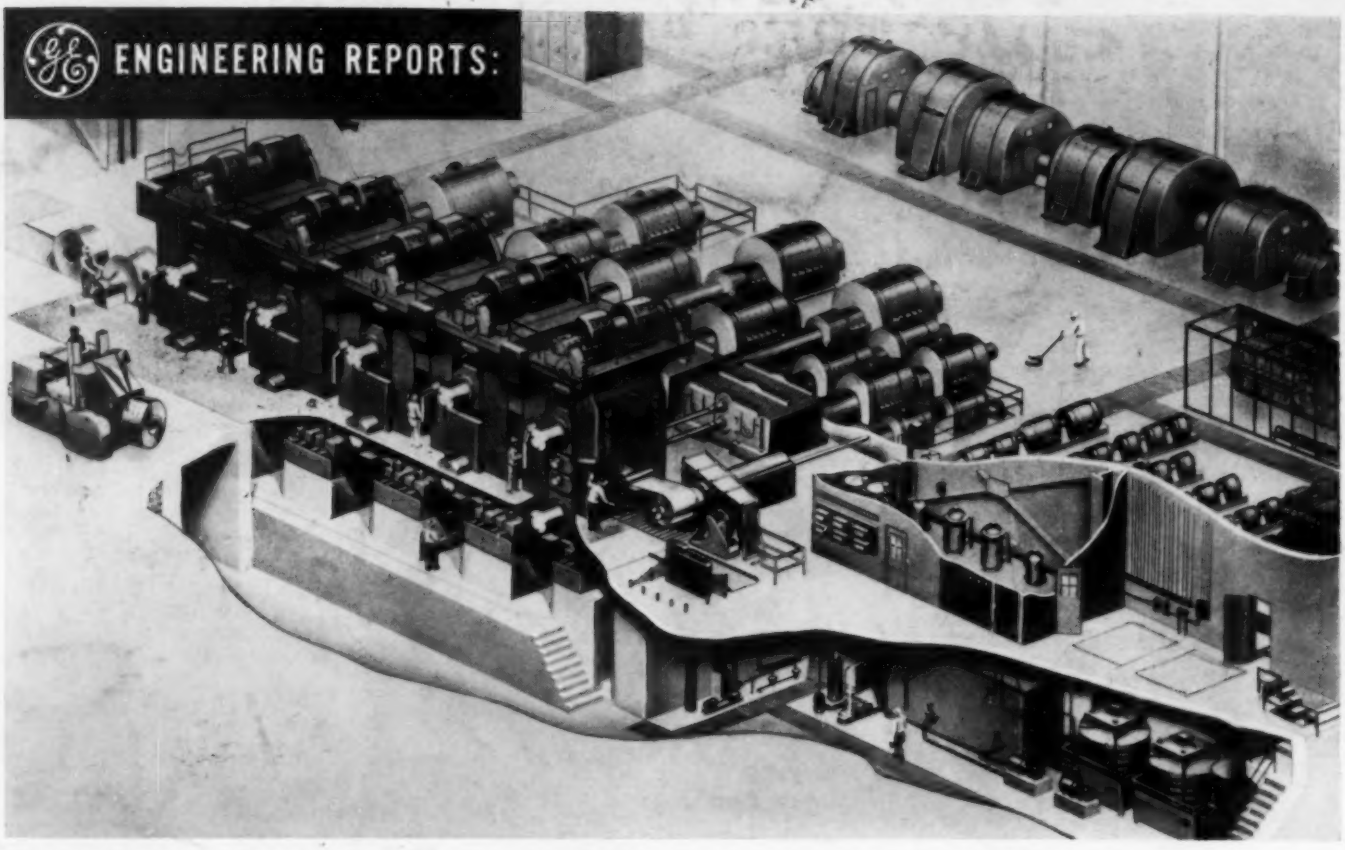
Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing In Canada: Peacock Brothers Limited.





Drawing shows component parts of the Farval Spray Valve Centralized System of Lubrication—manual pumping station, dual lubricant lines, compressed air line, single Spray Valve and nozzle. Both automatic and manual systems installed three years ago are in operation today, prolonging gear life, saving labor and lubricant.

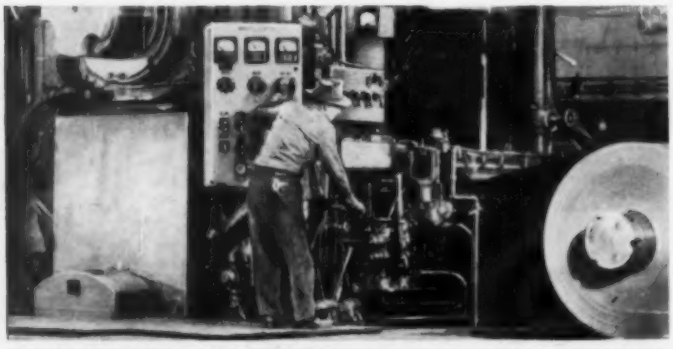
ENGINEERING REPORTS:



With the help of co-ordinated auxiliary drives,
Jones & Laughlin's Aliquippa mill . . .

Sets new record for rolling cold strip

FOR FAST POSITIONING, screwdown motors are controlled by General Electric amplidyne adjustable-voltage systems.



AMPLISTAT-AMPLIDYNE CONTROL on this 600-hp reel drive was one of first magnetic amplifiers on a cold strip mill.

At Jones & Laughlin's five-stand Aliquippa cold-mill, steel has been cold-rolled at a record-breaking 70-mph. Acceleration from standstill to top speed takes less than 12 seconds.

To help make these speeds possible, the mill's G-E auxiliary drives were engineered as a complete system and carefully co-ordinated with main drives. Result: besides standing up to record rolling speeds, these auxiliary drives enable the mill to perform daily at speeds higher than the maximum speed of most installations.

Despite this severe service, reliable G-E auxiliary drives require little maintenance. Operating costs are lower, and steel output is kept high.

Whatever your mill's electric needs, General Electric steel-mill application engineers can help you or your consultants co-ordinate your electric equipment for top performance. For further information, contact your nearest G-E Apparatus Sales Office and ask for Bulletin GEA-5570, or write to General Electric Company, Section 659-93, Schenectady 5, N. Y.

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

Engineered Electrical Systems for Steel-Mill Auxiliaries

GENERAL ELECTRIC